

January 1996

Mobile Radio Technology™

The journal of mobile communications technology

Servicing pagers, p. 10

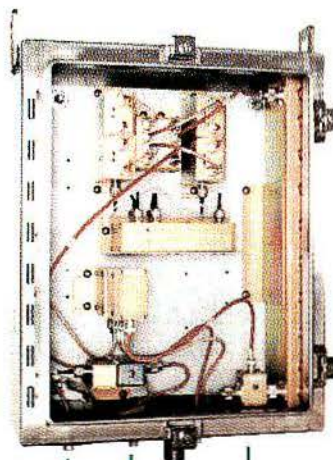
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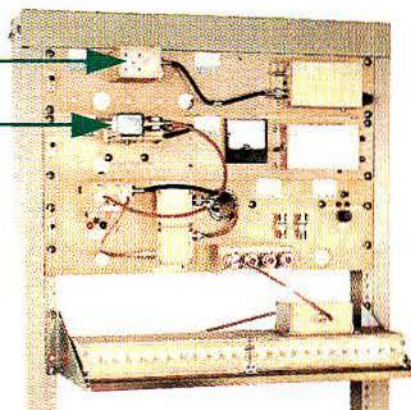
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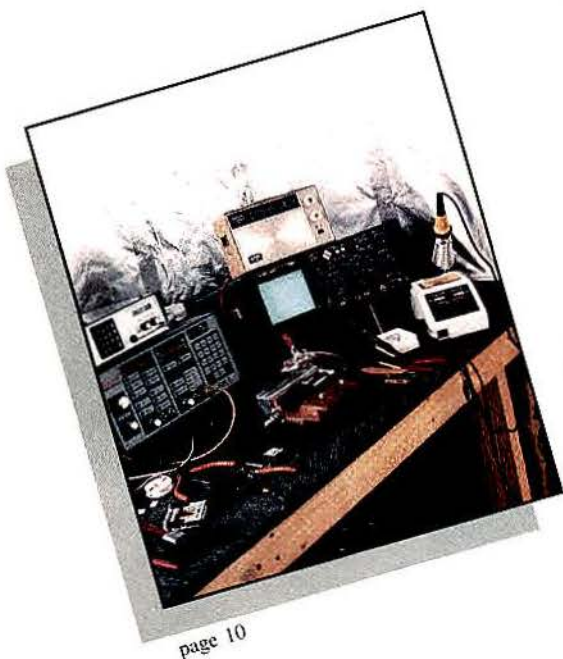
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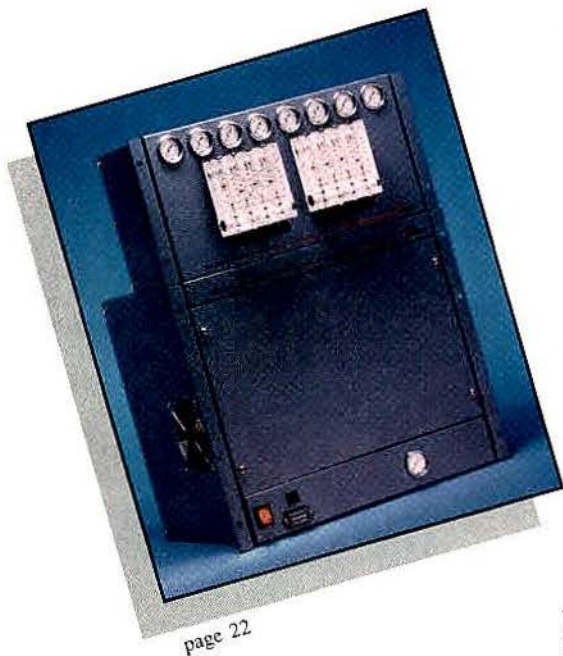
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On the cover: Antennas on top of the city hall in Kansas City, MO, serve a variety of public safety and local government agencies on various frequency bands. Installation of an 800MHz trunked radio system will consolidate many of the current radio systems into fewer antennas.

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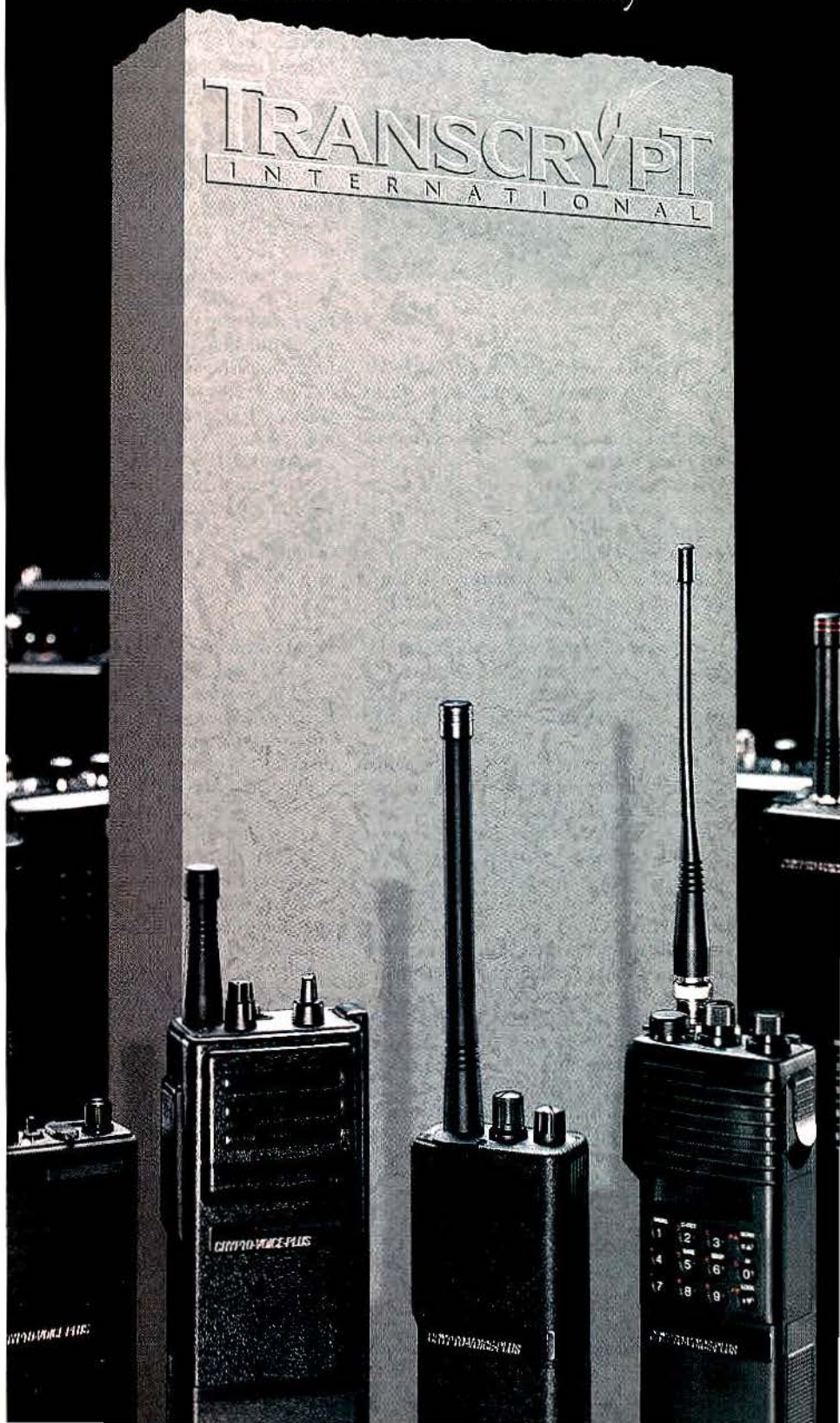
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High water marks on the editorial ivory tower



It's been a typical day in the *MRT* editorial ivory tower, overlooking the Sears Auto Center on Metcalf Avenue in Overland Park, Kansas. The mail brought about 40 press releases, three newsletters, several magazines, an article manuscript and some correspondence. The fax machine rolled out another 30 press releases, some more correspondence and an inquiry from a possible first-time article contributor describing his proposed subject. The phone received about 40 calls, and because of the timing, we answered about 20 of them as they came in, and either the voice mail or other editors answered the remaining 20 while we were on the line or away from the desk.

About a third of the press releases that come in the mail and most of the releases that come by fax have little to do with *MRT's* subject matter. The magazine is on lots of press release lists where it doesn't belong. It's harder to have our name removed from fax lists than mailing lists. Which takes more time? Reading enough of misdirected releases to know to discard them, or finding and communicating with senders in an effort to be purged from the list? Who knows? Many fax distribution systems are automated, and many times none of the people with the organizations mentioned in the releases have charge of the distribution lists.

Is this fax flow an indication of what will happen when we open the E-mail floodgates? That's coming soon. Is the editorial ivory tower high enough? Or will we need waders?

Some of the phone calls were from people who sent releases last week, check-

ing to see whether they arrived and whether we will print them. That's a gesture we appreciate. OK, so a call such as that is an interruption. *Every* phone call interrupts *something*, even if only a day-dream ... errr ... I mean ... a contemplative planning interval. More likely the intense scrutiny and preparation of someone's article for publication. Yeeeah ... that's better. But many phone calls bring opportunities, too.

Even though it takes effort to track releases to make it possible to tell people who inquire about their status in the publishing process, these conversations are worth it. We sometimes discover opportunities for feature article coverage that weren't apparent from the release. (Otherwise, we make the call!) Occasionally, these calls help us to get off an inappropriate distribution list. Meanwhile, the appropriate releases advance to print.

Don't worry, by the way, about whether *your* phone calls, faxes or mail apply to us. You're reading this magazine, right? (Up to this point, anyway!) So it's more than likely that what you have to tell us has to do with the subjects we cover. You're always welcome to get in touch.

* * *

Senate hearings

As we write this commentary on Dec. 1, word is that the U.S. Senate may hold a hearing in December in which small SMR operators can explain their plight. Many of them have been blocked from expansion because the FCC granted licenses to so-called wide-area system operators that take up all available channels, despite the certainty that the wide-area operators never will construct systems on all of those channels—those in medium-size and small markets and in rural areas, for example.

Why did the wide-area operators file for licenses they never will use? One reason may be to put spectrum on their balance sheets as an asset with some purported value that supports the price of their stock. Another reason may be to stifle the growth of small SMR operators so the wide-area SMR operators can capture at least a few customers on the percentage of licensed systems that might be built.

We hope an airing of FCC policies and the effect they have on small business will persuade Congress to put the commission on a better course that protects the small

SMR operators and makes it possible for them to grow.

* * *

900MHz auctions

By the time this reaches print, the 900MHz SMR auctions will have been conducted. They were scheduled for Nov. 28, but they were delayed by the federal government employee furloughs.

It will be impossible for many auction winners to meet the specific coverage requirements imposed by the FCC unless they combine their businesses with incumbent 900MHz SMR operators in large cities within the geographic areas defined in their licenses. Isn't that a hoot? You buy the spectrum at auction, but to keep the license after five years, you either have to merge your business with someone else's, sell to that other operator or buy the other operator's systems. Who comes up with this kind of plan? This problem might be expected to cause trouble with the sale of spectrum for use in geographic areas that include large cities such as New York, Los Angeles, Chicago and San Francisco.

* * *

Radio service consolidation

The FCC wants to abolish the old license assignment system that separates user groups into blocks of channels in which they share channels with similar users. It asked for advice about how to reduce the present 20 radio services to as few as two to four, with one being composed of public safety users.

The industry could not reach a consensus on this one—What a surprise! Some trade associations want to keep more than four services or even the present 20 (not an option, according to the FCC), and others are willing to see a consolidation to two services. Our bet is that the FCC will take the opportunity to cut 'em back to two. Here's the division:

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All we have to do now is wait and see.

—Don Bishop

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17-19—**Mobile Communications Conference**, sponsored by Frost & Sullivan, Westin Galleria Hotel, Dallas. Contact: Amy Arnell, 415-961-9000.

March

11-13—**Western States Regional Conference of the International Association of Public-Safety Communications Officials**, Riverpark Convention Center, Spokane, WA. Contact: Pamela Ratcliffe, 206-774-3583.

17-20—**Energy Telecommunications and Electrical Association**, Dallas Convention Center, Dallas. Contact: 214-235-0655.

25-27—**Wireless**, sponsored by the Cellular Telecommunications Industry Association, Dallas. Contact: 202-785-0081.

April

24-26—**International Wireless Communications Expo**, Las Vegas Convention Center, Las Vegas. Contact: 800-828-0420.

29-May 1—**Vehicular Technology Conference**, sponsored by IEEE Vehicular Technology Society, Westin Peachtree Hotel, Atlanta. Contact: Jim Worsham, 404-804-3543.

May

14-17—**PCIA Spring Government Conference**, sponsored by the Personal Communications Industry Association, Washington Hilton, Washington, DC. Contact: Nancy Palleschi, 202-467-4770.

29-31—**Canadian Wireless**, sponsored by the Canadian Wireless Telecommunications Association, Metro Toronto Convention Center, Toronto. Contact: 613-233-4888.

June

16-20—**UTC National Conference & Exhibition**, sponsored by UTC, The Telecommunications Association, Marriott Hotel and Bartle Hall Convention and Civic Center, Kansas City, MO. Contact: 202-872-0030.

24-27—**Supercomm**, sponsored by USTA and TIA, Dallas Convention Center, Dallas. Contact: 202-326-7300.

July

11-13—**Communications Expo/Show of the Americas**, Miami, FL. Contact: 305-229-9992.

August

11-15—**International Association of Public-Safety Communications Officials (APCO) National Conference**, San Antonio, TX. Contact: 800-949-2726.

September

19-21—**Personal Communications Showcase**, sponsored by the Personal Communications Industry Association, Moscone Convention Center, San Francisco. Contact: 800-326-8638.

October

30-Nov. 1—**WirelessWorld Conference and Exposition**, sponsored by *Cellular Business* and *Mobile Radio Technology* magazines, Orange County Convention/Civic Center, Orlando, FL. Contact: Susan Link, 913-967-1969.

November

15—**Radio Club of America**, Communications Symposium, 87th Anniversary Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Ron Formella, 201-652-6811.

Mobile Radio Technology

The journal of mobile communications technology

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Are you a good 'RF neighbor'?

By Harold Kinley, C.E.T.

It is always a good practice and a common courtesy to limit noise and spurious emissions from your transmitter to a level that will not cause harmful or destructive interference to your "RF neighbors." Sometimes this may be difficult to achieve—especially when frequency spacing and physical spacing of antennas are very close. This month we will take a look at some of the commonly encountered problems and what goes into making a good "RF neighbor."

'Me first'

One of the greatest difficulties in dealing with such problems as transmitter noise is the human aspect. Some people have the idea that if they were on a particular transmitter site first then they have no obligation—legally, morally or otherwise—to accommodate other users. They will not assist in reducing transmitter sideband noise to a non-interfering level or to a less-interfering level—even though the interfering noise level is devastating the reception at receivers even 1MHz to 2MHz away. This is not a good "RF neighbor"! Fortunately, most people are not of this category.

Maximum 'raw' power

Then there are those who *must have* the absolute maximum amount of power they can muster poured into a high-gain antenna to achieve maximum effective radiated power (ERP)—without any bandpass cavities or isolators between the transmitter and the feedline. A few believe that even a reduction of 0.5dB to 1dB caused by the insertion of a bandpass cavity or isolator might cause a serious reduction to the system range. Never mind that their transmitter noise is causing a 15dB deg-

radation to your receiver! This is also not a good "RF neighbor"!

Response

Once a complaint of harmful interference is made, the owner of the interfering transmitter should respond promptly. Allowing harmful interference to continue unabated for days is not indicative of a good "RF neighbor"!

Technical aspects

Sometimes the technical aspects of solving an interference problem are easier than the human aspects—but not always. Extremely tight spacing of antennas and frequencies can make a transmitter noise problem or a receiver desense problem practically impossible to resolve—even if the owner of the offending transmitter is very willing to be accommodating.

► *Example* — A high-power paging transmitter, located at a mountaintop site and operating at a frequency of 152.500MHz, causes severe degradation to a receiver operating at a frequency of 151.100MHz. To determine just how much degradation was occurring, the "effective site sensitivity" test was run. (See Figure 1 below for the test setup.) First, with the offending transmitter *off*, the signal generator level was increased to produce 12dB SINAD at the receiver output. Then, with the offending transmitter keyed *on*, the signal generator level is increased to again produce 12dB SINAD at the receiver output. The difference between the two signal generator levels is the amount of degradation the offending transmitter is causing to the receiver. This is the amount of extra isolation needed between the transmitter and the receiver. In this example, an additional isolation of 15dB was needed.

There are two ways this interference could be cured. One is by the use of a

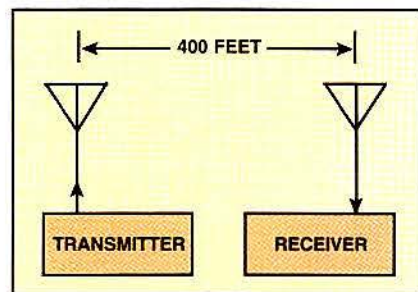


Figure 2. The offending transmitter and affected receiver in the example in the text have antennas with a horizontal separation of approximately 400 feet.

high-pass notch filter installed on the transmitter. Another is by the use of a bandpass cavity installed on the transmitter. Any filtering for transmitter noise must be installed at the transmitter and not at the receiver. There is nothing that can be done at the receiver to abate the transmitter noise.

All transmitters are not created equal. Some produce much more sideband noise than others. Generally, the sideband noise is around 90dBc (decibels below carrier level) at 30kHz removed from the carrier and around 105dBc at 1MHz from the carrier. It should be noted that this is more than the legal requirement, but good, state-of-the-art equipment will exceed the minimum requirements by far. We can use these typical figures to analyze a typical situation.

In Figure 2 above the transmitter and receiver are separated by a horizontal distance of 400 feet. The transmitter output power is 380W, which is equivalent to 56dBm. It is easier to work with dBm or dBW—I prefer dBm. The line loss between the transmitter and the antenna is 1dB, and the antenna has a 9dBd gain. At a horizontal separation of 400 feet, the isolation between the transmitter and the receiver is about 55dB. The gain of the receiving antenna is 6dBd. The isolation is reduced by an amount equal to the sum of the gains of the transmitter antenna and the receiver antenna. Now, if the transmitter noise is down by 105dBc at

(continued on page 36)

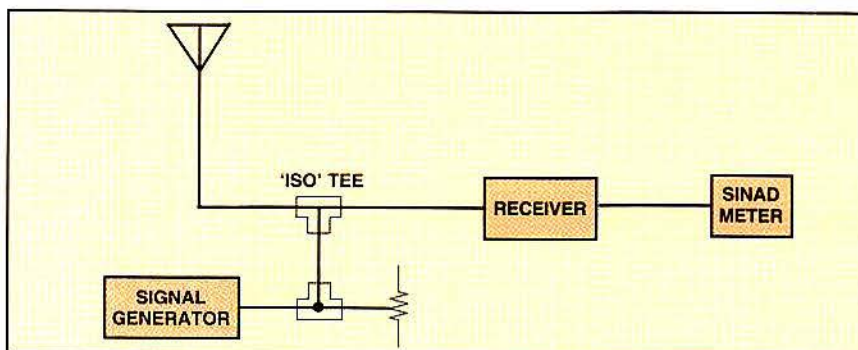


Figure 1. This 'effective site sensitivity' test setup is used to determine the amount of degradation caused to a receiver by the offending transmitter noise.

Kinley, a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, Prentice-Hall, 1985. He is a member of the Radio Club of America.

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Servicing pagers: The 'tinfoil tomb'

Part 19—Use aluminum foil to build a do-it-yourself shielded room and overcome oxidation and breakage problems associated with rooms made of copper circuit-board material. Proper earth grounding plays a key role.



Photo 1. This is the northeast corner of an 8' x 9' x 7' room with a fluorescent light fixture near the center of the ceiling. The walls and ceiling are gypsum-board; the floor is 8-inch concrete.



Photo 2. Applying the shielding began by hanging 8-foot lengths of 15-inch aluminum foil directly on the wall. Overlapping pieces are stapled directly to the wall with office paper staples.

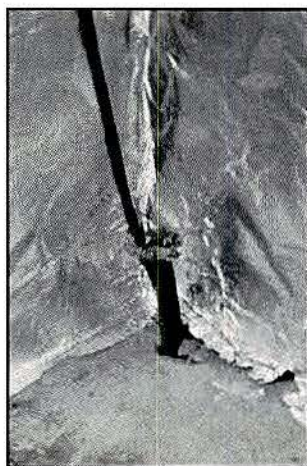


Photo 3. A hole is drilled through the concrete floor at the northeast junction, and a 4-foot-long, 5/8-inch-diameter copper ground rod is driven into the underlying soil for an earth ground connection.



Photo 4. The No. 4 ground wire is bonded mechanically and electrically to the foil at the juncture of both walls and the floor. Foil-backed tape is applied to the entire length of each section's seam.

By David Ludvigson

"Servicing Pagers: Build a Shielded Room," the first article in this series (January 1994), described a do-it-yourself shielded room made of copper-clad, circuit-board material. I like to call it the "copper coffin," because receivers "die" when they are brought into the room.

Although the original design works well, it is difficult to build. Moreover, extended use has revealed the need for several modifications, and sometimes individual "tiles" of circuit-board material must be replaced for the room to retain effective shielding. Corrosion and the inevitable cracked circuit board require a "minesweeping" exercise with a transistor radio to locate RF leaks.

Ludvigson is a technician in Houston.

The copper coffin's costs were largely absorbed in the acquisition of several pieces of test equipment, but 70 tiles at \$6 per tile (not including the intensive labor) added up to an expensive project. There had to be another way.

Some tests conducted at home used a 4-foot cube covered with aluminum foil sold for home use. The cube was connected to an earth ground, and a transistor radio placed within it could not receive a 1kW AM broadcast station three miles away.

The combination of a remodeling project at JJ Sounds and the maintenance problems with the copper coffin led us to try aluminum foil for RF shielding.

Photo 1 above left shows the northeast corner of a room measuring about 8' x 9' with an overall height of about seven feet. A single fluorescent fixture mounts in the center of the ceiling. The walls and ceiling are constructed of standard two-by-fours with gypsum-board walls and ceiling

placed on an 8-inch concrete floor.

Construction began by hanging 8-foot lengths of 15-inch aluminum foil directly on the wall. Overlapping pieces were stapled with office paper staples directly to the wall. (See Photo 2 above.)

At the northeast junction of walls and floor, a single hole was drilled through the concrete and a 4-foot-long, 5/8-inch-diameter copper ground rod was driven into the underlying soil. Without a connection to this ground, the surrounding foil has virtually no effect on receiver sensitivity to AM or FM broadcast stations. *If the room is not fully and completely earth grounded, it will not work.*

By the way, just because an electrician says a connection to a ground rod is good does not necessarily mean that it is. Photo 3 above shows oxidation around the clamp. Despite an electrician's opinion, the connection was not grounded. The clamp had to be removed, the rod cleaned and the

technicians.

Circle (9) on Fast Fact Card

clamp reset to make a truly effective ground. Perhaps the path of the copper rod abraded the oxidation on its way into the earth.

At this point, bringing a transistor radio near a grounded section of foil revealed some attenuation of broadcast band signals, but overlapping joints were leaking RF badly. Passing the broadcast band receiver next to a joint while applying enough pressure to seal the junction caused

further signal reduction.

"Ground" is one thing to a radio communications technician. To an electrician, "ground" is *neutral*, and neutral may or may not have anything to do with an earth ground.

With respect to the "tin foil tomb," the electrical service's earth ground is nearly 70 feet from the junction box used for power distribution to the shielded room. This earth ground consists of a 1/2-inch rod

driven into the earth and clamped to the conduit that extends to the junction box. Several mechanical junctions of the conduit were physically separated from each other, and a few showed a dc short-circuit when an ohmmeter was connected

Pager servicing series

Part 1: "Build a Shielded Room," January 1994. (All pagers.)

Part 2: "Build an 'IFFER,'" February 1994. (Bravo, Bravo Plus, Bravo Express.)

Part 3: "Frequencies, Coding Formats," March 1994. (Bravo.)

Part 4: "From Bench to Programmer," April 1994. (Bravo.)

Part 5: "The Receivers," May 1994. (Bravo.)

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Part 13: "Mixed Signals," February 1995. (Bravo.)

Part 14: "Essential Differences," April 1995. (Bravo Plus, Bravo Express.)

Part 15: "And You Shall Receive Knowledge," June 1995. (Bravo Plus, Bravo Express.)

Part 16: "The Information Highway," July 1995. (Bravo Plus, Bravo Express.)

Part 17: "450MHz Receiver Boards," August 1995. (Bravo Plus, Bravo Express.)

Part 18: "Logic/decoder Boards for Bravo Plus, Bravo Express," November 1995. (Bravo Plus, Bravo Express.)

Part 19: "The 'tin foil tomb,'" January 1996 (All pagers.)

End of Series

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Editor's Note: David Ludvigson has made an arrangement with the publisher to offer a compilation of all the articles for purchase. He also is preparing a videotape with pager servicing information based on his articles. You can reach the author at Toltec Communications Resources, Pasadena, TX; tel. 713-947-7660 or 713-946-5521.

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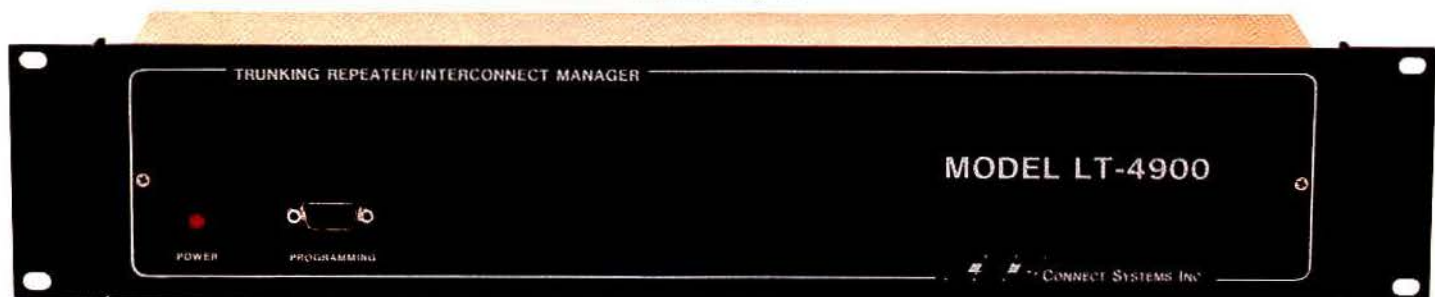
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Construction expenses for the shielded room included:

Five rolls 15-inch × 200-yard aluminum foil	\$30
Five rolls 2-inch × 50-yard aluminum tape	\$14
Twelve 2 × 2-inch, 8-foot lengths of construction pine	\$20
Four sheets 4 × 8-foot, 3/4-inch plywood	\$48
Five 2 × 4-inch, 8-foot lengths of construction pine	\$14.50
Total cost of major building materials	\$126.50
Two 4-foot copper ground rods	\$60
Electrical work and materials	\$400
Total cost of electrical labor and materials	\$460

on either side of the mechanical junction.

To improve the grounding, another 5/8-inch copper rod was driven into the earth a few inches from the "grounded" conduit. An 8-foot length of No. 4 gauge stranded copper wire was run to the junction box, and *neutral*, whatever its electrical poten-

tial might have been, was *grounded*.

Electrical service to the "tin foil tomb" consists of two independent branches, each on a separate 20A breaker. Four double outlets were used with sets 1 and 3 on one branch and sets 2 and 4 on the other.

Aluminum conduit and junctions were

abraded to maintain "interruption-proof" dc integrity at each end before being joined mechanically. It is not enough merely to pass a green-coated wire through the conduit back to the earth ground, but that had better be done, too.

On each side of the ac line, in the outlet boxes, a 0.1µF, 600V bypass capacitor effectively reroutes to ground any RF coming down the power lines. Without these bypass capacitors, the transistor radio would "come alive" when passed near the outlets. These same capacitors render wireless intercoms nearly worthless as a means of room-to-room communications.

Photo 4 on page 10 shows the placement of a foil wrap around the No. 4 ground wire. This wire is grounded mechanically and electrically to the foil at the juncture of both walls and the floor.

Foil-backed tape is applied to the entire length of each section's seam. The seams could be taped with virtually any type of tape, but foil-backed tape maintains the visual monotony! Taping each seam prevents RF leakage through each junction.

The floor

Photo 5 on page 16 shows how a double-

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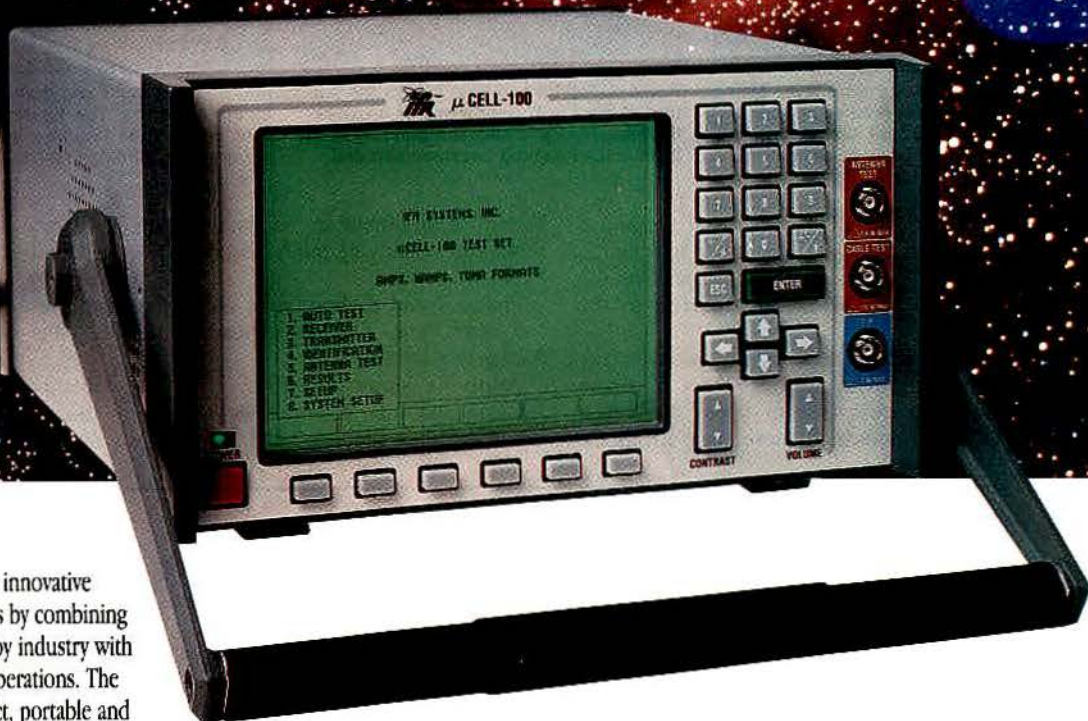
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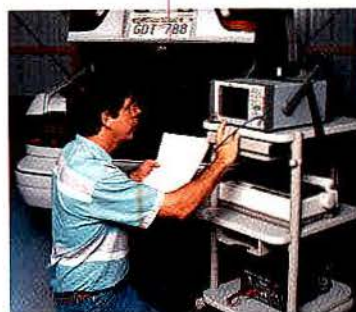
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Photo 5. A double-layer of foil on the floor is taped and bonded to the wall foil. Crosspieces will support the floor deck.



Photo 6. Foil-backed tape covers the bottom of the 2"X2" floor frame of interlocking crosspieces to maintain bonding even if the underlying foil becomes abraded.



Photo 7. The southeast corner before shielding. The fluorescent light fixture requires bypassing and bonding to the foil.



Photo 8. The southeast corner after shielding. The foil, floor support lattice and electrical service boxes are put in place.

layer of foil is laid, taped and bonded to the protruding wall foil shown in Photo 2. Liberal use of foil-backed tape virtually hermetically seals the flooring to the walls.

John Espinoza's custom woodworking provided an interlocking 2" X 2" frame and filler crosspieces to support the 3/4-inch plywood floor. Foil-backed tape covers the

bottom of this frame to maintain bonding should the underlying foil be abraded. (See Photo 6 above.)

Photos 7 and 8 above right are *before* and *after* views of the southeast corner during construction.

Applying spray-on adhesive, Irving Johnson and John Espinoza covered the exposed ceiling (Photos 9 and 10 on page

18) and then placed the foil. (See Photos 11 and 12 on page 18.) Again, these overlapping junctions were stapled and taped to prevent RF leakage.

The dangling fluorescent light fixture was bypassed with capacitors (using the method described earlier) and bonded to the ceiling foil. A receiver picks up some residual hum near the fixture, but

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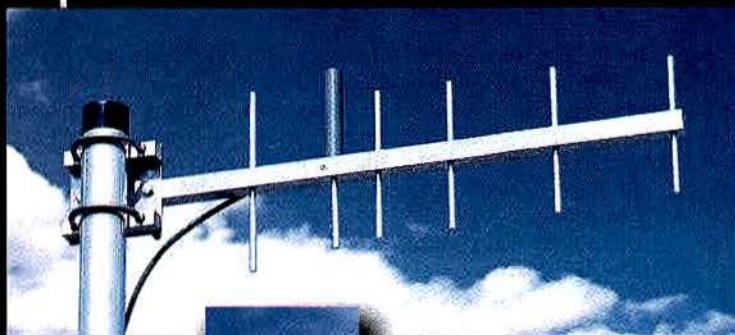
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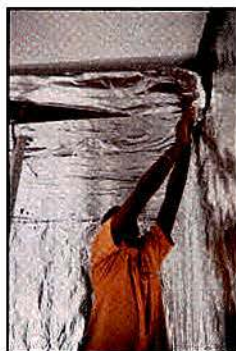
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Photos 9-12. John Espinoza (on the left in the first two photos) and Irving Johnson cover the exposed ceiling with spray adhesive and then place the foil. The overlapping junctions are stapled and taped to prevent RF leakage.

RF signals are virtually eliminated.

Unlike the copper coffin, the door to the "tin foil" tomb was simple to construct. Photo 13 on page 20 shows that a single layer of aluminum foil was simply stapled directly to the door, folded around the door thickness, and then taped to secure the gaps. The door jamb was treated similarly, becoming in essence an external laminate to the existing woodwork.

Flooring inside the "tin foil tomb" is about two inches above the concrete floor

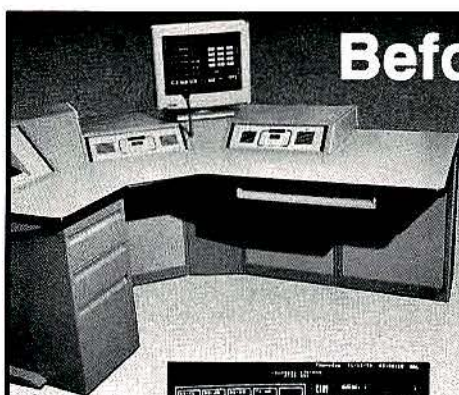
at the entrance, so foil from the floor was form-fitted around a two-by-four used as a threshold. This configuration provides metal-to-metal contact between the threshold and the door when the door is closed. The elevated floor was covered with carpeting.

Next, a table was constructed along the north wall. This, too, was covered with aluminum foil and bonded to the walls. Over the tabletop, a layer of gray carpeting provides a bit of insulation from the foil. There is not much value in building a table

that "shorts out" the circuitry being worked on.

Photos 14 and 15 on page 20 show the equipment setup. From left to right are a Panavise's mount used to secure various boards for servicing, a Ramsey COM 3 service monitor and a KNS Enterprises Cushman multifunction POCSAG/Golay generator.

The large black unit with the blue screen is a Tenma 72-920 40MHz dual-trace oscilloscope. Atop this unit is the modified AM radio described in the February 1994



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Photo 13. Aluminum foil is stapled directly to the door, folded around it, and then taped to secure the gaps. The door jamb is treated similarly.



Photo 14. The table for equipment used to service pagers has been built in the northeast corner of the shielded room, close to the earth ground connection.

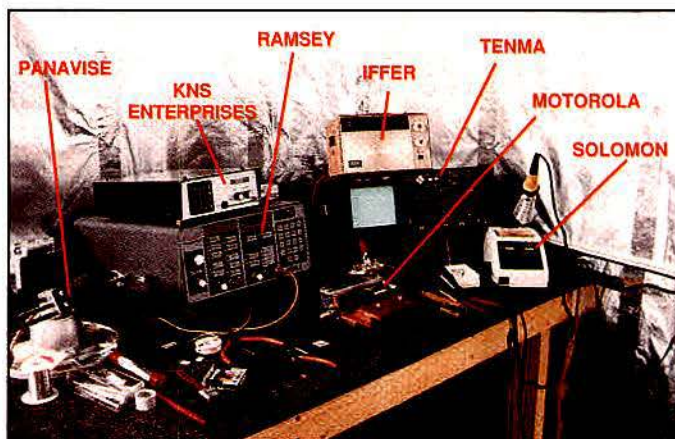


Photo 15. Equipment used for pager servicing includes a PanaVise mount, a Ramsey COM 3 service monitor, a KNS Enterprises Cushman multifunction POCsag/Golay generator and a Tenma 72-920 40MHz dual-trace oscilloscope. Additional equipment includes an 'IFFER,' a Solomon Brothers SL-10 soldering station and a Motorola RTL 1005 radiation test fixture.

article "Servicing Pagers: Build an 'IFFER.'" A Solomon Brothers SL-10 soldering station (available from Micro Alarm Systems, 800-736-2999) provides temperature-controlled soldering convenience. For \$42.50, it is a surprising value, and it includes a grounding post (guess

where that is connected?) and multiple replacement tips.

At front and center is the Motorola RTL-1005 radiation test fixture, surrounded by hand tools and repair aids. In the white box next to the soldering station is a jeweler's loupe, a 10-power monacle that

attaches to the eyeglass bow.

Project expenses are detailed in the box on page 14.

How does it work?

Preliminary testing shows little difference between the copper-circuit-board and the aluminum-foil-shielded rooms. Both require excellent grounding, and both provide about 50dB of attenuation to 930MHz signals. With the aluminum version, copper oxidation is a thing of the past, and any RF leaks can be fixed with a patch of aluminum foil and aluminum tape.

With both rooms, RF has to be piped in by coax connectors to bring in enough signal for a pager to receive on-the-air signals. Received signal strength on a pager is roughly equivalent to that generated by the Ramsey Com 3 when the attenuator is at full minimum (X1 scale with variable attenuator set at minimum). The room is effective.

Acknowledgement

My thanks to Raymond Duran, Irving Johnson, John Espinoza and Leo Rodriguez at JJ Sounds and Communications. South Houston, TX, for their help with this project. Additional thanks go to the management and staff of Toltec Communications Resources, Pasadena, TX, for their help with this project. Tel. 713-947-7660. My thanks as well to readers who have called with thought-provoking questions and kind words about this article series.

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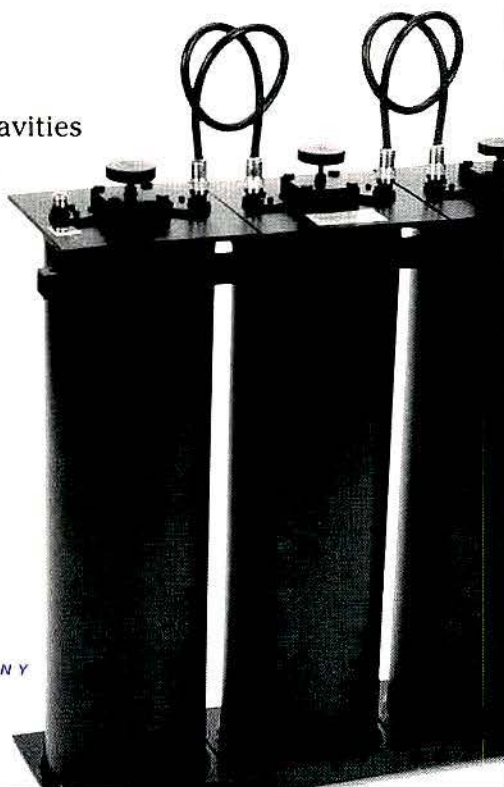
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Selecting dry air systems: Static vs. dynamic dehydrators

Air-dielectric transmission lines used at wireless communications base station sites require dry air to prevent voltage breakdown and corrosion that may result from moisture condensation.

By Lloyd A. Keyser

The process of selecting a system to supply dry air for air-dielectric transmission lines must take into consideration the trade-off of initial capital equipment expenditure vs. the total labor cost of monitoring and maintaining the system.

Providing dry air may be achieved by using a low-cost, static, disposable desiccator that may last several months, depending on system volume. These units typically have a low equipment cost but a high labor cost of monitoring and maintenance. The alternative is to use fully automatic equipment involving negligible labor cost. Other factors to be considered are monthly site access, availability of electrical power and the system volume to be pressurized.

Four types of dry air systems can be

used at wireless communications base stations. Several of these also can be used with small earth-station antennas and microwave systems, and the last one is also appropriate for broadcast applications.

Static desiccators provide dry air passively. (See Photo 1 below left.) In a nonpressurized system, a static, passive-breathing desiccator eliminates moisture. As the system out-gases because of an ambient temperature increase, the air escapes through the desiccator. When the system in-gases external ambient air, moisture is absorbed by the desiccant as the air is drawn into the system. Lowering the dew point requires many exchanges of air because the system cannot be initially purged by the static desiccator.

The advantages of the static desiccator are low cost, quiet operation, and no power consumption. The unit has no moving parts and can provide many months of protection. The disadvantages are the annual labor cost to monitor the system and the change-out of the saturating desiccator. If it is not changed, the desiccator will begin to release moisture back into the system.

Static desiccators are popular in earth station antenna systems. In general, one unit is recommended for feeds and combiners with less than 1ft³ (28 liters) volume. Two units are best for feed and combiner systems between 1ft³ and 2ft³. Two desiccators may be installed on separate pressure inlets, or they can be combined using 1/8-inch NPT fittings on a single gas inlet.

For microwave antennas connected back-to-back with waveguide as long as 10 feet, one unit will suffice. In slightly longer runs, a unit at each end is preferable. The static desiccator mounts directly to any pressure inlet having a female 1/8-inch NPT fitting. It must be mounted in a location that is easily accessible for viewing and replacement.

The typical service life of a system with a



Photo 2. Hand pumps are lightweight, portable, and robust enough for extensive handling.

1ft³ volume that experiences a temperature change of 10°C (30°F) per day is several months at 40% relative humidity. This life varies with the leak rate of the system and the geographic average relative humidity.

Static manual regenerative desiccators can be used with systems containing as much as 10ft³ of air. (See Photo 2 above.) Hand pumps containing desiccant may be considered as nonautomatic desiccators because there is no automatic replenishment of pressure to the system. Hand pumps are lightweight, portable air-drying systems capable of pressurizing as much as 30lb/in² (210kPa). Moisture removal is accomplished by passing ambient air through a cylinder of silica gel desiccant. A color change indicates when it is time to replace the gel or rejuvenate the desiccant. The pump must not be used after the desiccant changes color.

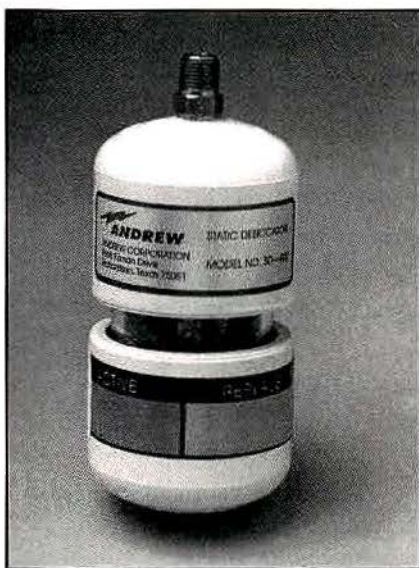


Photo 1. A small, disposable passive static desiccator with a clear viewing indicator to monitor the desiccant condition and a 1/8-inch NPT female pipe fitting for installation.

Keyser is business unit manager for the pressurization product line at Andrew Corporation, Orland Park, IL.

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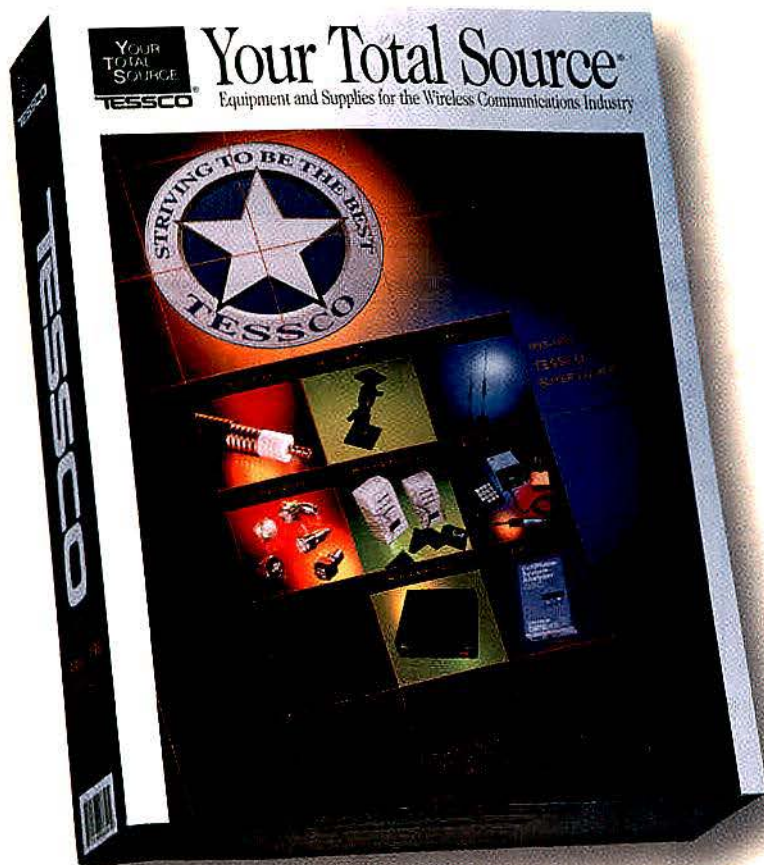
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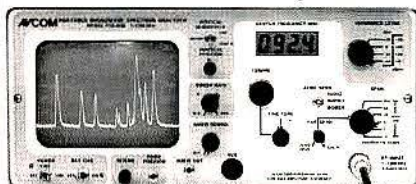
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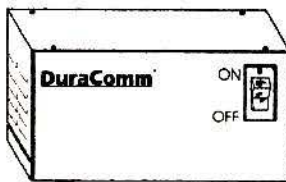
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Table 1—Equipment cost vs. system volume.

TYPE	CAPACITY					
	0ft ³	2ft ³	10ft ³	70ft ³	140ft ³	400ft ³
STATIC (PASSIVE)		\$62				
STATIC (PRESSURIZABLE)		\$468-\$635				
MANUAL REGENERATIVE		\$1,070-\$1,320				
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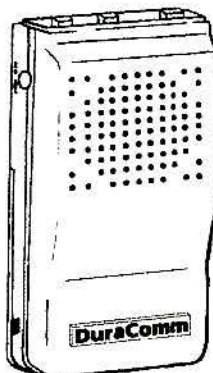
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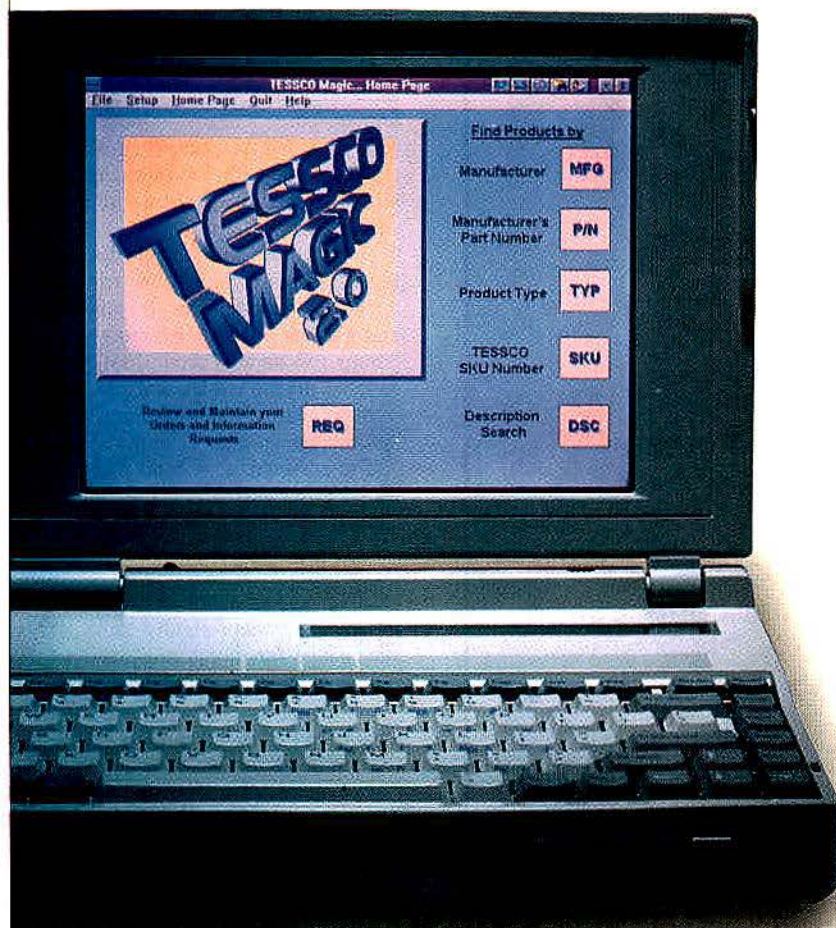
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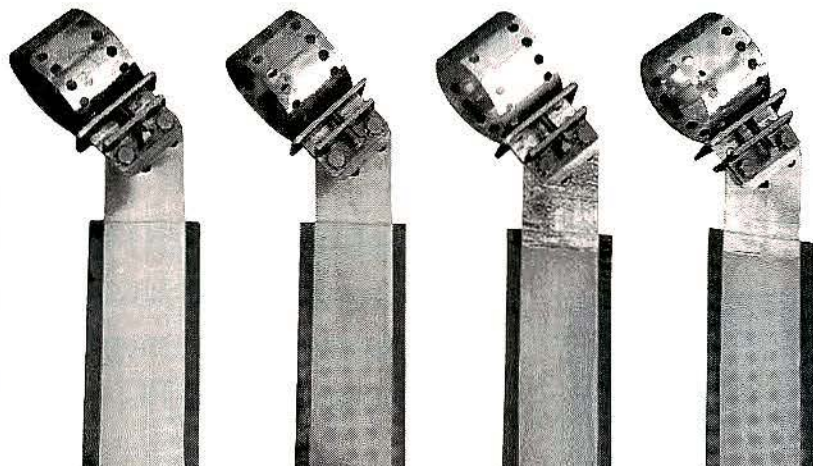
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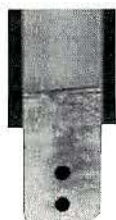
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Photo 3. Designed for either a 19-inch relay rack or 120mm slimline racks, manual regenerative units can absorb as much as 400ft³ of moist air before rejuvenation. Viewing windows allow monitoring of the desiccant saturation level.

The desiccant may be rejuvenated by baking in an oven at 177°C (350°F) for about four hours until its original color returns. The desiccant must be allowed to cool in a sealed metal container, or it will absorb moisture while cooling. Initial system purging of three volume changes is recommended. It takes 80 strokes to purge a 1ft³ volume with one air change. To pressurize the same volume requires 5.5 strokes per 1.0lb/in².

Hand pumps are suitable for pressurizing any small, tight, electromechanical apparatus that requires dry air to protect against the ingress of moisture. Hand pumps can supply about 135ft³ (3,857 liters) of dry air under ambient conditions of 40% relative humidity and 21°C (70°F) before regeneration is required.

The advantages of hand pumps are low initial cost, portability and light weight. The disadvantages are the labor cost to monitor the pressure in the system, supply the dry air from the pump and either replace or regenerate the desiccant after saturation. The system usually contains a pressure gauge for monitoring pressure. Hand pumps with gauges are also available. The system pressure gauge and gas inlet fitting should be placed for easy access to attach the pump air hose.

A dynamic manual regenerative system can be used to dry as much as 10ft³ of air. (See Photo 3 above.) A dynamic system replaces dry air automatically between pre-set low and high pressures. These dehydrators provide dry air by using a larger desiccant container than a hand pump. They are capable of adsorbing moisture from 200ft³ to 400ft³ (using one or two desiccant canisters) of 40% relative humidity air at 70°F (21°C) before regeneration is required. Depending on system leak rate and relative humidity, the desiccant will maintain -40°F dew point for several months.

The cost of the dynamic dehydrator is higher than for a static unit, but the dynamic system automatically maintains

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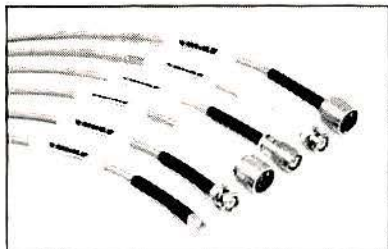
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- Uses any two wire voice grade circuit.



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Photo 4. A membrane dehydrator is the industry's most advanced system for pressurizing transmission lines. This unit has been designed for small systems with as much as 10ft³ of air.

pressure and adsorbs many times the moist air volume of static units before the desiccant needs to be replaced or regenerated by baking. These units contain a compressor, pressure switch and desiccant canister. They are ideal for small, tight systems with as much as 10ft³ of air and are capable of purging a small system. Their advantages include:

- ☐ automatic operation.
- ☐ low power consumption.
- ☐ flexible mounting.
- ☐ 10- to 15-year life expectancy.
- ☐ low pressure alarm.
- ☐ optional alarms.

The disadvantages include:

- ☐ manual regeneration or replacement of the desiccant.
- ☐ power consumption.
- ☐ moving parts.
- ☐ low purge.
- ☐ system volume.

The desiccant may be replaced during monthly or quarterly site inspections once the saturation rate is determined.

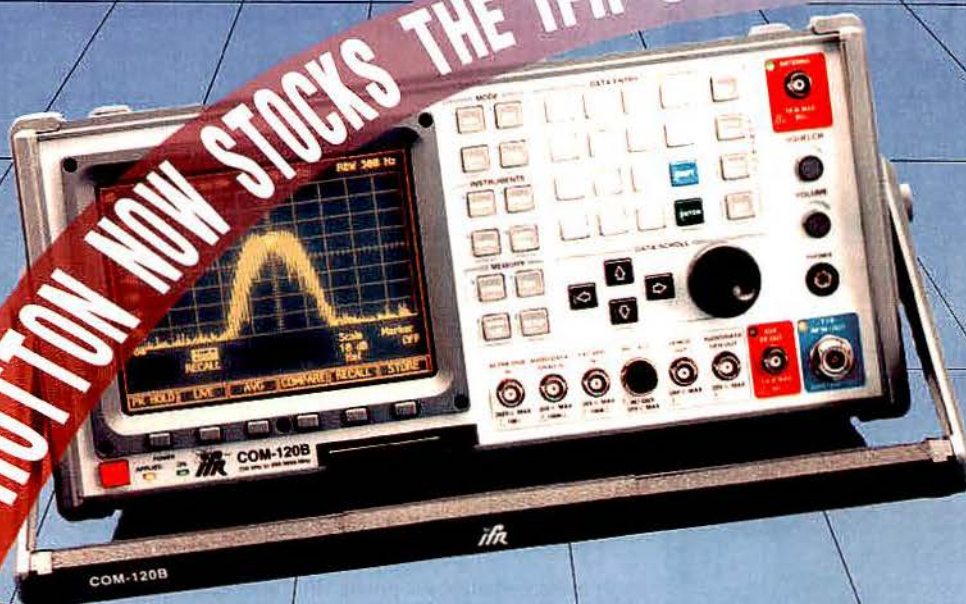
The fully automatic, dynamic dehydrator not only provides dry air between



Photo 5. This compact membrane dehydrator is an 8-port system in a convenient two-chassis package. It has an installation kit for large systems with as much as 70ft³ of air.

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Table 2—Total system cost.

	STATIC PASSIVE	STATIC PRESSURIZABLE	MANUAL REGENERATIVE	MEMBRANE SMALL CAPACITY	MEMBRANE MED. CAPACITY	MEMBRANE LARGE CAPACITY	MEMBRANE HIGHEST CAPACITY
ENERGY REQUIRED	0	0	100W	230W	390W	780W	1,580W
ANNUAL ENERGY COST (\$.08/kWh; 5% DUTY CYCLE)	0	0	\$4/YR	\$8/YR	\$14/YR	\$27/YR	\$55/YR
INSTALLATION COST (SINGLE PORT; \$35/HR. LABOR)	\$20	0	\$20	\$25	\$30	\$30	\$50
MAINTENANCE COST (\$35/HR. LABOR)	\$393 A	\$956 B	\$212 C	\$35 D	\$35 D	\$35 D	\$50 D
TWO DESICCANT CHANGE	\$124	\$56	\$44	N/A	N/A	N/A	N/A
EQUIPMENT COST (PRORATED OVER 10 YEARS)	N/A	\$47	\$107	\$190	\$200	\$273	\$433
TOTAL YEARLY COST	\$537	\$1,059	\$387	\$258	\$279	\$365	\$588

A—Includes weekly system verification and two units changed per year. Does not include travel time.

B—Includes system verification, repressurizing and two changes of desiccant per year. Does not include travel time.

C—Includes one filter change and two desiccant changes per year. Does not include travel time.

D—Includes annual filter replacement. Does not include travel time.

pressure-switch set points, but also contains a self-regenerating passive membrane drying process. In this unit, the number of parts is greatly minimized because the drying process consists of only one passive component: the drying membrane tube. The unit is designed to provide cyclic or continuous dry air.

Membrane dryers are relatively new to the industry. (See Photos 4 and 5 on page 28.) They offer exceptional reliability and dew points in excess of -45°C (-50°F) under the ambient conditions of 95% relative humidity at 49°C (120°F). Mean time before failure (MTBF) is as high as 55,000 hours, calculated per MIL-HDBK-217F, which is double the industry standard for pressure-swing or heat-regenerative dryers. A feedback system on some membrane models generates system dew points in excess of -65°F . The feedback system uses a small amount of dry system air that flows back through the dryer until the compressor again responds to the system. The major benefits are continued system drying and elimination of moisture stratification in the system. There is also no need for bypass kits for small systems nor the use

of air tanks to increase system volume.

Moisture separation is achieved by the permeation process through an inert, maintenance-free fiber material. Some advantages of using membrane dryers are:

- lower than industry-standard dew points.
 - increased MTBF due to fewer parts.
 - operational indicators.
 - higher capacity per compressor size.
 - flexible mounting.
 - optional alarms and programmability.
- Disadvantages are:
- power consumption.
 - moving parts.
 - some compressor noise.

Labor cost vs. capital expense

Table 1 on page 24 and Table 2 above summarize the cost of static vs. dynamic supply of dry air to a single-line system. The system types range from the smallest-volume, most economical, disposable static desiccator to the fully automatic, programmable, high-volume dehydrator. Table 1 compares the equipment cost of various types of dehydration vs. system volume. Table 2 summarizes the yearly costs of various types of dehydration.

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Cold, hard facts— on snow plow installations

Keeping radio communications flowing among dispatchers and operators of snow removal equipment is much easier with proper installation and maintenance than with service calls during bad weather.



A purpose-built snowplow usually has higher vibration than multipurpose vehicles used for clearing snow.



Protecting cables is important. Using existing protection saves time and money.



Attaching radio power leads to a purpose-built snowplow battery control panel simplifies installation.

By Donald E. Koehler

Northern-tier states (including Alaska) experience snowfalls in varying depths throughout the winter. The depth and density of the snow generally determine the type and amount of snow removal equipment that various agencies use. Snow plows fall into two general categories: *purpose-built* and *multipurpose*. Some vehicles are made specifically for snow removal. Others typically are dump trucks fitted with plow blades and sand spreaders for winter use. The dump beds then are refitted for other purposes in other seasons.

When installing communication systems in snow plows, it is important to take into consideration the vibration, hot-and-cold temperature cycling and moisture on and in the equipment. Particular care must be taken to protect the equipment, wiring, antennas, cables and interconnections. Ways to make the equipment easy for the vehicle operator to use should be explored prior to installation. Let's start by examining some ways to eliminate or reduce vibration.

Both snow removal and power transfer from the drive line that moves the power head cause rotary snow plows to vibrate. Using buffer materials under a "standard" mount supplied with the radio may seem like a good idea, but a buffer rarely provides the security necessary to hold heavy radios for long. A better choice may be aftermarket mounts with integral vibration dampers. Additionally, mounting the radio body away from the power head or cab will help, because the remote panel assemblies of today's modern radios are both

Koehler is the owner of Communication Specialties, Anchorage, AK.



The battery bank on a purpose-built snowplow generally has a large capacity; nevertheless, a low-voltage cutout to protect equipment should be considered.



Ensure adequate clearance between strobe lights or accessories and antenna components.



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light and rugged, making it easier to protect them from vibration. Multipurpose trucks offer a wider range of equipment mounting options because of reduced vibration levels. Placing the radio behind the operator's seat or on an elevated mount under the seat may be a workable low-cost option—if the equipment is protected.

Protecting equipment from hot-and-cold temperature cycles and from moisture is the biggest challenge facing the installer,

regardless of snow plow type. Few agencies can afford indoor, heated parking for their plows. Once the plow engine is turned off, either for servicing or at the end of a shift, the cab interior cools quickly. When the plow is return to operation, the cab is reheated, and the temperature cycle starts again.

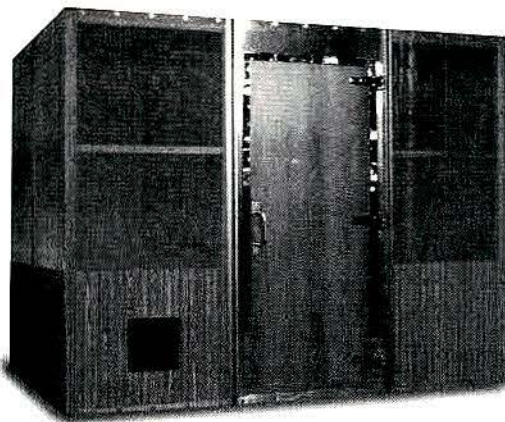
Fortunately, few areas experience the extreme temperatures of the Alaskan North Slope, where -40° sometimes is the daily



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high reading, and trucks are run continuously. This hot-cold cycling can loosen internal connections and promote corrosion, and it makes wire insulation extremely brittle. Ensuring that the wiring harnesses are tucked up and secured out of the way of boots or that they are protected when they are routed under the operator floor areas will go a long way toward preventing mid-winter calls to repair equipment outages. Periodic maintenance and interior inspections of communication equipment are vital to ensure all connections are both clean and tight. Remember to look into the "barrels" or bodies of mating connectors, ribbon cables and other areas where moisture can collect. Corrosion is insidious, and it will ruin wire even in "clean" connectors. If in doubt, seal the connector with an approved conformal coating. In extreme cases, the expense of potting compound may be justified.

Antennas and cables suffer in the cold. If de-icing fluid or salt is used around your equipment, inspect the antenna system components periodically. A light coating of non-conductive silicon grease can help to prevent or to reduce rust and corrosion on antenna base parts. Do not use room-temperature vulcanizing (RTV) sealants because they generate an acid when curing and actually promote corrosion. Cables should be secured and protected from chafe, pinching and movement. The newer plastic tie wraps are inexpensive, but become brittle quickly in a



Check battery voltages as part of installation planning.



Make it easy for the operator to use the communications equipment. Controls should be easy to reach, with speakers close to the operator for audibility despite high noise in the cab.

harsh environment. Check these at the same time you check the antenna system. When in doubt, replace!

Plows used at airports are likely to have roof-mounted strobe lights to make them highly visible to operations and safety workers on runways and taxiways. Maintain minimum clearances for antennas from these strobes to reduce interference. Aircraft band radios generate sidebands (they are amplitude-modulated, after all) that can cause interference to installed land mobile radio (LMR) equipment. External filters may be required. Do not start the installation without checking first. Antennas mounted on multipurpose trucks have to clear the dump bed. Once again, check first.

Talk with the plow operator, if at all possible, before installation begins. The placement of audio speakers is important because plows are noisy, and the operator may have an opinion about speaker placement. Operators may wear thick gloves, so check with them to see if the standard microphone will be usable. You may want to consider aftermarket accessories for the microphones, such as moisture guards to prevent freeze up, or oversize push-to-talk (PTT) buttons for easier operation with a gloved hand.

A little planning and some discussion with the end user will help you to perform a long-lasting and professional installation of communications equipment in snow plows.

Acknowledgement

My thanks to Tom Eral, Bobbie Frisby, Rich Hittle and the rest of the professional staff at the Anchorage International Airport maintenance division for the chance to crawl around the toys.


ATA

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Circle (31) on Fast Fact Card

TRANSMITTER POWER	56dBm
TRANSMITTER LINE LOSS	-1dB
TRANSMITTER ANTENNA GAIN	+9dB
TRANSMITTER NOISE AT 1.4MHz	-105dB
ANTENNA/ANTENNA ISOLATION	-55dB
RECEIVER ANTENNA GAIN	+6dB
RECEIVER LINE LOSS	-1dB

NET NOISE LEVEL AT RECEIVER INPUT -91dBm

EFFECTIVE RECEIVER SENSITIVITY = -112dBm

ADDITIONAL SUPPRESSION = -10dB

NOISE LEVEL NO GREATER THAN -122dBm

NOISE LEVEL AT RECEIVER INPUT = -91dBm

SHOULD BE SUPPRESSED TO -122dB

ADDITIONAL SUPPRESSION NEEDED 31dB

(continued from page 8)

1.4MHz, then the noise level at the receiver is -91dBm. The box above summarizes the calculations. Figure 3 on page 37 is used to convert between microvolts and dBm or dBW. Figure 4 on page 37 is used to convert between power in watts and dBm or dBW.

Notice that the noise level at the receiver input will be -91dBm. That level would mean that for the transmitter noise to cause less than 1dB degradation to the receiver, the transmitter noise must be reduced 10dB below the receiver sensitivity level. Because the receiver sensitivity level is 0.3µV, or -118dBm, the transmitter noise must be reduced to

-128dBm. However, the noise floor at the transmitter site is such that the bench sensitivity is reduced by 6dB, yielding a site sensitivity of -112dBm. It follows that the offending transmitter noise need be reduced to only -122dBm to cause minimum degradation to the receiver.

To accomplish that noise reduction, an additional attenuation of -91dBm - (-122dBm), or 31dB, is needed. This attenuation can be accomplished through bandpass or bandreject cavities placed on the offending transmitter. A bandreject cavity would improve conditions for only one receiver, whereas the bandpass cavity would potentially improve conditions for any receivers operating at a frequency near the offending transmitter frequency. A bandpass cavity also would lower the overall noise floor at the transmitter site.

Uncontrolled sites

There are too many transmitter sites that are running totally out of control. That is, no one person has a handle on what is being placed in operation at the particular site. If one transmitter is allowed to radiate excessive noise over a huge bandwidth, imagine how many receivers are going to be adversely affected. Is it fair to

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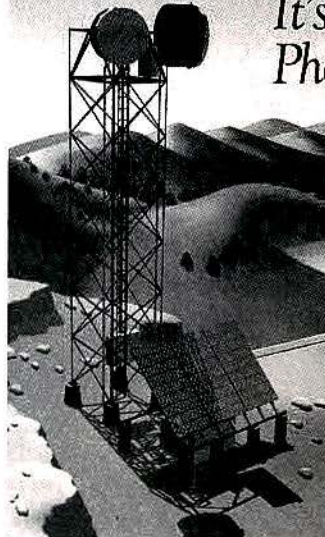
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Technically speaking

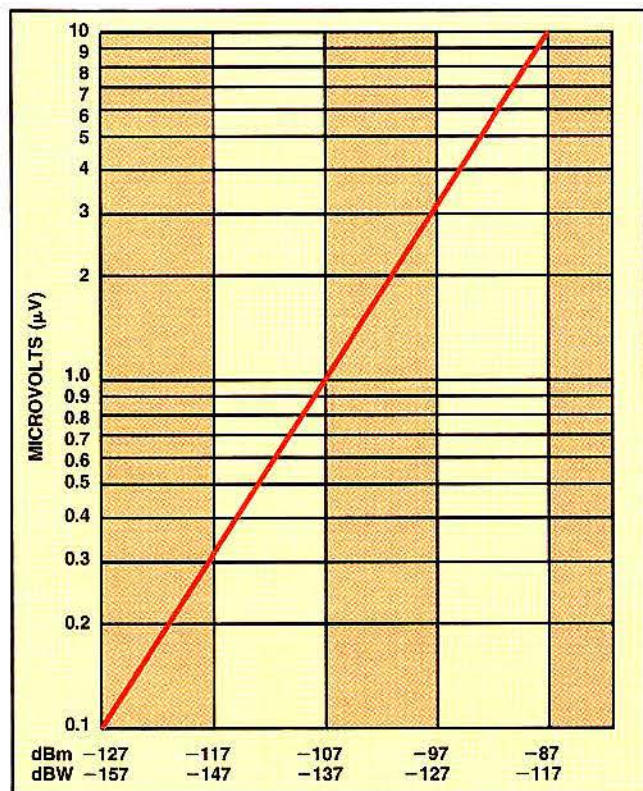


Figure 3 (left). Use this graph to convert between microvolts and dBm or dBW.

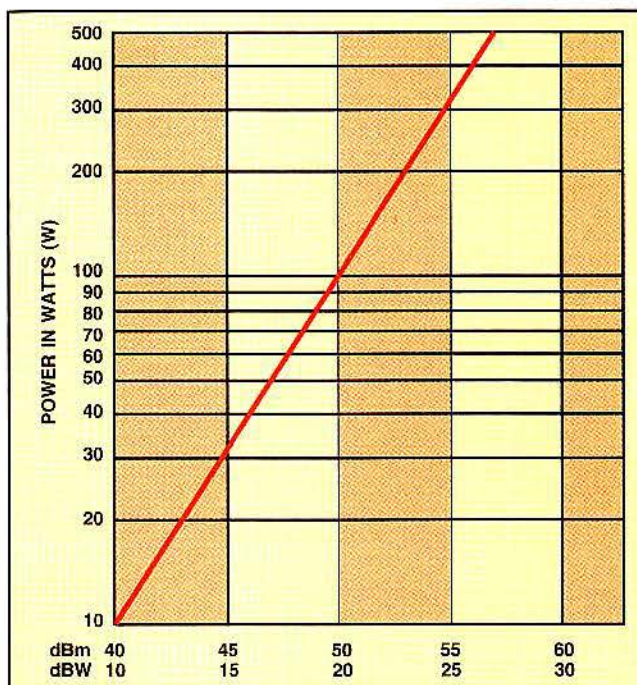


Figure 4 (above). Use this graph to convert between power in watts and dBm or dBW.

allow a transmitter to run excessive (albeit legal) power into a high-gain antenna with absolutely no bandpass filtering or isolation installed on the transmitter between the feedline and the antenna? Hardly!

At uncontrolled sites, it is up to the individual owners of transmitting and receiving equipment to work together in the spirit of cooperation to reduce harmful interference to on-site receivers. Most people are willing to be reasonable and cooperative in trying to suppress noise from their transmitter to a level that is tolerable. Running high, unfiltered RF power into an antenna is not being considerate of your "RF neighbors"! Generally, at least one high-Q bandpass filter and a single isolator should be used on the transmitter at a populated transmitter site. This should be done *before* any complaints are received. The RF spectrum is the property of no one. It must be shared and protected by all of us to our mutual benefit. Even at uncontrolled sites, voluntary efforts by those using the site can make the situation much more bearable for all. Are you a good "RF neighbor"?

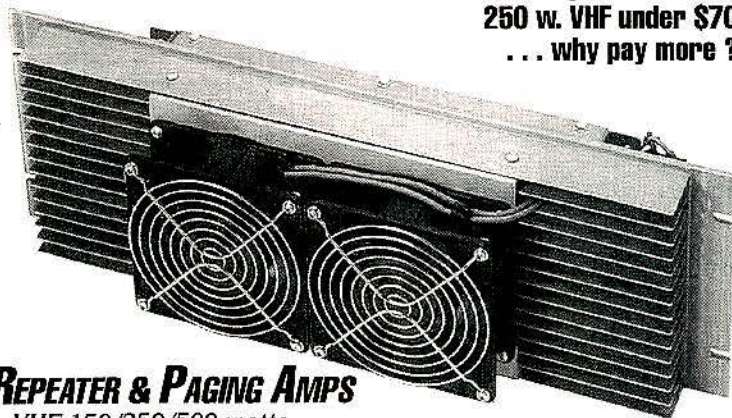
Until next time—stay tuned!

The information in this month's column is based on a personal experience. The owner of the offending transmitter turned out to be a good RF neighbor. Fortunately, through cooperation, the interference was cleared up.



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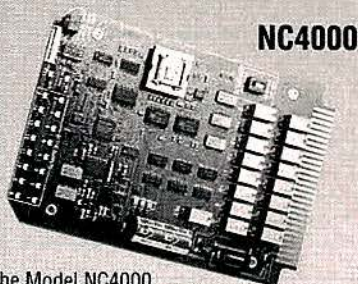
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Circle (34) on Fast Fact Card

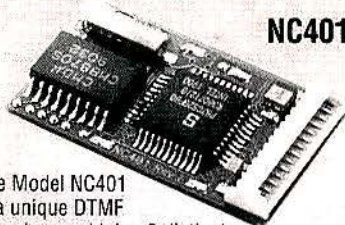
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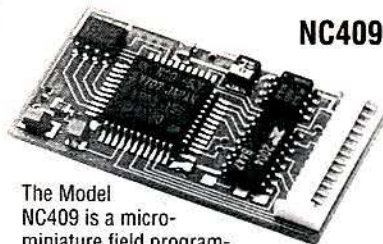
NC4000

The Model NC4000 is a multi-function field programmable DTMF Encoder/Decoder providing 11 modes of operation, 16 relayed outputs and 14 input sense lines for status reporting and is a compatible replacement for Speedcall's Model C527 and Vega's Model 780 series decoders.
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NC409

The Model NC409 is a micro-miniature field programmable DTMF ANI Encoder, providing 15 memories, LNR, TOT, BLO, man-down and alarm functions in one highly versatile and feature packed unit.
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Circle (35) on Fast Fact Card

R egulating technology

United we stand

By Robert H. Schwaninger Jr.

Over the last month the campaign against the FCC's efforts to relocate, rearrange, redistribute and rejoin SMR operators has been in full swing. The experience has given me renewed hope about the future of small, independent businesses in the industry.

Independent SMR operators' futures are being threatened by a rulemaking in Docket 93-144. The proposed rules would take away the earned value of 800MHz radio systems, strip operators of their right to compete in a free marketplace and sell their collective business futures on the FCC's auction block. "What do I hear for this broken promise? As a special, added bonus we're throwing in dashed dreams — no charge!"

Trying to give a unified voice to the independent businesses that are the foundation of our industry has been quite educational. I learned that even if certain people agree with you, they will damn your efforts with faint praise. I learned that if you cannot accept "compromise" when it really means "capitulation," people will call you crazy. I relearned that no matter how hard you try to do your best, some lawyer or politician or bureaucrat will say it could have been done better.

However, despite the criticism and backbiting that I have endured (usually with a chuckle, because self pity ain't my strong suit), I have found that people still admire a fighter. As long as there are some nitwits willing to stand up for what's right, people will root for them. And you have. And I thank you.

Some of the more interesting things that happened are worthy of reporting. Here are a few tidbits that illuminate the problems that the SMR operators have faced.

lems that the SMR operators have faced.

"It's not about money."

Inside Chairman Reed Hundt's office, hanging over the receptionist's desk, is a 5' x 2' check, written for about \$7 billion, to commemorate the FCC's success in holding PCS auctions. After passing under this looming reminder, members of SMR WON and myself were told by Ruth Milkman, Hundt's senior legal advisor, that the proposed 800MHz auctions were not motivated by revenue production. Given the trophy hanging in the outer office, that claim was her toughest sell.

The silent majority

In the public meeting held on September 18, the Wireless Telecommunications Bureau said that the 800MHz auction proposals would be adopted because a majority of the commentors supported adoption. The sound of jaws hitting the floor was deafening. Last count, it appeared to me that there were about two FOR and 200 AGAINST. OK, the two votes in favor were AMTA and Nextel, but I think that even those two don't constitute a majority of the industry. (PCIA is still reserving its opinion.)



Just one more thing...

At the September 18 meeting, the FCC staff said it had the whole scheme figured out, except one minor detail. In the proposals the FCC said SMR operators might be required to migrate to "comparable spectrum." The staff requested additional comments on what the industry thought the FCC meant by comparable spectrum. If that question strikes you as extreme, in light of the FCC's intended actions, join the choir. Without a final determination of that central question, the affected SMR operators don't know whether they would be moved next door or be sent on a Trail of Tears.

Can't we just get along?

Even at this late date, the FCC staff is still asking the SMR operators whether there is some way a compromise might be

Schwaninger, MRT's regulatory consultant, is a partner in the law firm of Brown and Schwaninger, Washington, DC. He is a member of the Radio Club of America.

reached. This begs asking how far the FCC is willing to move. I haven't seen any indication that the FCC is willing to budge on the primary points that would destroy the future competitiveness of affected operators. Although some agreement might be found arising out of quid pro quo, right now the FCC hasn't provided a hint of quid or a clue regarding quo.

Same _____, different day.

As usual, changes in the Communications Act often come without warning. How about his one? In the Budget Bill, Congress has asked for significant changes in the Communications Act, including the statutory language regarding the FCC's auction authority. Under the new language, the FCC would have authority to auction off any spectrum, including private radio channels. The only exceptions are public safety and (shock o' shock) broadcast spectrum. Seems like Congress is interested in raising money as long as it doesn't come from the media moguls. Perhaps this move will some day be referred to as the "Unfairness Doctrine."

Overnight success

One of the arguments that favors the

FCC's 800MHz proposals involves regulatory parity. In other words, all comparable operators should be subject to comparable regulation. Therefore, I wish to congratulate all of the single-channel conventional 800MHz operators. You've attained the same exalted status as the New York City MSA cellular carrier. It's *amazing* what hard work can do.

A new hope

There are many more strange comments and weird meetings that have occurred in light of the efforts to curtail the FCC's agenda at 800MHz. Some are so bizarre that words fail me.

SMR operators *are* making progress. Congress is becoming educated on the subject and on the effects that adoption of the proposed rules will have. Ten members of Congress signed a letter to the FCC protesting adoption. Two senate offices asked the Department of Justice to examine the anticompetitive impact of adoption. The possibility of congressional hearings is edging closer to reality.

By the time you read this, I will have filed formal motions before the U.S. Department of Justice and the Federal Trade Commission, each asking for the depart-

ments to examine the matter and to determine whether the FCC will be acting in a manner detrimental to competition and outside of its authority.

More operators are visiting their congressmen face-to-face to voice their extreme rejection of the FCC's justification for adoption of the proposals. Alicia Clemens, executive director of SMR WON, is in town for two weeks, engaging in the fine art of lobbying (listed in the college extension course materials as Gadfly 101).

To every operator that has commented to the FCC, signed a petition, placed a call to Congress, written a letter, supported a motion, hired a lawyer, organized a group, pounded the table and generally screamed "NO!" at the top of your lungs, I wish to thank you. You have shown courage and an unwillingness to quit. You have shown that it can't always be "business as usual." You have shown that your future is just as important as the future of the largest telecommunications companies in America. And you've scared the hell out of the people who thought you'd just roll over and play dead.



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Congressmen send letter of concern to FCC about proposed auction of 861MHz-866MHz frequencies

A letter expressing "strong concern" over the FCC's proposals to auction frequencies already licensed in the Specialized Mobile Radio (SMR) bands from Congressman Michael D. Crapo and signed by 11 Congressmen was delivered to FCC commission chairman Reed Hundt. Copies of the letter were delivered to each commissioner.

The letter states that the "auctioning of licensed spectrum was not authorized in 1993 by the Congress" and that this "misguided policy now under consideration by the commission poses an immediate threat to the livelihoods of ... small businesses."

As the FCC's proposed rulemaking in Docket 93-144 has been debated, SMR WON (a non-profit organization of inde-

pendent SMR operators) has mobilized its membership to further educate public officials and others regarding the negative effect auctioning occupied spectrum could have on small business, consumers and the overall public.

Bird acquires TX RX Systems

Bird Electronic, Cleveland, has acquired TX RX Systems, Angola, NY, and also formed a new RF component division called Bird Component Products. These two divisions plus Bird Electronic will operate as the Bird Technologies Group. The TX RX Systems subsidiary will continue to operate from Angola, NY. The Bird Component Products subsidiary was formed to exploit new proprietary technology for passive RF devices. Bird Electronic will maintain its focus on the design and manufacturing of RF instrumentation.

Cubic Communications acquires OAR's direction-finding products

Cubic Communications (CCI), San Diego, has acquired the direction-finding product line assets of Ocean Applied Research (OAR), San Diego, for an undisclosed amount of cash. Under the terms of the sale, CCI has purchased the rights to the name "Ocean Applied Research" and the acronym "OAR." The acquisition allows CCI to offer additional direction-finding capabilities with its growing line of surveillance receivers and systems. OAR will continue operations at its Sorrento Valley facility until it is integrated into CCI's Ponderosa Avenue plant in an orderly manner.

Motorola, ON Technology join to provide software to E-mail users

Motorola's Personal Communicator Systems and Software (PCSS) division, Boynton Beach, FL, and ON Technology, Cambridge, MA, have made an agreement to provide PCSS' Air Apparent wireless communications software application to users of ON Technology's DaVinci eMAIL free of charge. This agreement will allow DaVinci eMAIL users to send wireless messages directly to paging subscribers from their desktop without the assistance of a telephone dispatch service. As part of the agreement, a two-user coupon for Air Apparent for NetWare will be included with each copy of DaVinci eMAIL. Users can customize DaVinci eMAIL to automate messaging tasks such as paging a user when an urgent E-mail is sent to an in-box.



Receive only

	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dBm)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	\$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	\$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	\$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	\$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	\$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar	\$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar	\$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	\$119.95

Inline (rf switched)

	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dBm)	Device Type	Price
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	\$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	\$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar	\$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar	\$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	\$139.95

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Circle (37) on Fast Fact Card

MTA-EMCI projects 60 million U.S. cellular subscribers by 2000

In its most recent study, The U.S. Cellular Marketplace: 1995, MTA-EMCI projects that by 2000 there will be more than 60 million cellular subscribers. Combined cellular and PCS subscribers will total more than 80 million, with an average 1.8 subscriptions per household with a mobile telephone. This results in a total household cellular and PCS penetration of more than 43%. Business use as a percentage of total cellular use has declined from 52% in 1992 to 38% at mid-year 1995. This trend of increasing personal cellular phone use is likely to continue.

Motorola contracts with Hark to supply site monitoring equipment

Hark Systems, Summerville, SC, has been contracted by Motorola, Schaumburg, IL, to provide tower site monitoring equipment. This equipment will monitor tower lights and alarm inputs, as well as to provide remote card access. Equipment will be sold directly to Motorola, as well as on the open market.

Andrew installs communications system for Denver airport

Andrew, Orland Park, IL, has completed the installation of an RF mobile communications system in the Denver International Airport. The network is designed to distribute mobile communications signals—including a total of more than 200 channels of trunked radio, UHF radio, cellular and paging services—within the buildings and underground areas of the airport.

Radiating coaxial cable functions as a continuous antenna, helping to resolve wireless communications problems inside buildings and tunnels.

ITA launches electronic coordination

ITA, Arlington, VA, has launched its electronic coordination product, Relay 600. Private wireless users can use this service to apply for new licenses or to modify or renew existing licenses. Using the software, the applicant provides ITA with a minimal amount of data on the two-way radio system. ITA's staff then prepares the FCC Form 600, coordinates the frequencies and submits the filing for FCC licensing. Relay 600 transmits to ITA's BBS, which provides members and clients with query and information services. The BBS also provides users with file-transfer capability and access to news bulletins, regulatory filings, application status reports and E-mail.

Tower school accepted to U.S. telecommunications training institute

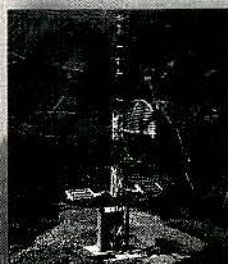
Educational Services, a division of Broadcast Communications, New Glarus, WI, has been accepted as an instructional provider to telecommunication men and women in 151 countries. They join other companies such as Alcatel, AT&T, Bellcore, IBM, Harris, Motorola and Northern Telecom as training leaders in the U.S. communications industry. The

joint venture between these companies and ranking officials from the U.S. Federal Government provides a comprehensive array of training courses to communications professionals in other countries. The goal of the United States Telecommunications Training Institute is to foster "global growth through communications sharing."



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Circle (38) on Fast Fact Card

Readers' choice

Of all the new products and services in the May 1995 issue, the one reprinted here generated the most reader requests for additional information. If you missed it the first time, here is your opportunity to acquire more information on it. Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Alarm system transmits voice messages over two-way radio

CES Technologies' Crime-Link Radio Alert System can be wired to an existing alarm control panel, or it can stand alone. When tripped, the unit transmits voice alarm messages over a two-way radio system. Two field-programmable voice messages can be individually tripped. Features include battery backup, DTMF re-

mote control, accessory power jack, low battery indicator, power supply, whip antenna and wall-mount enclosure. Remote control features include arm/disarm, system status and voice message check. Transceiver packs are available in all frequency ranges including 800/900MHz trunked systems.

Circle (500) on Fast Fact Card

Trunking repeater manager includes front panel LCD



The LT-4200 LTR trunking repeater manager from **Connect Systems** is designed to be compatible with the repeater bus used by all major brands. This control panel includes a front panel LCD that displays current user ID, repeater status, HELP data and programming details. All adjustments are readily accessible by removing the front panel while the controller remains operational in the rack. Front- and rear-panel RS-232 ports allow use of a modem, PC or laptop to perform local or remote programming in addition to downloading programming data and user time accumulations.

Circle (401) on Fast Fact Card

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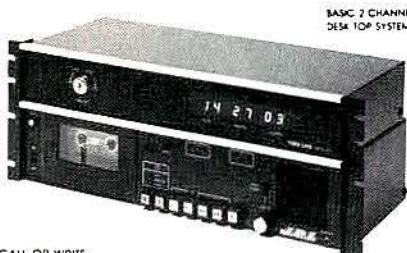
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Circle (39) on Fast Fact Card

Two-in-one amplifier redesign provides broadcasting backup

VoCom Products has redesigned its 800MHz and 900MHz amplifiers. Each transistor is mounted on its own pallet for repairs in the field. The 140W 800MHz and 120W 900MHz amplifiers are each designed with two amplifiers, a predriver and an afterburner. In the event the final stage should need to come off the air, the predriver amplifier will continue broadcasting at 75W and 60W, respectively.

Circle (402) on Fast Fact Card

VoCom's RF Power Amplifiers

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| • UHF Low Band | 25, 50, 100, 200 & 350 Watts |
| • 800 MHz | 40, 75 & 140 Watts |
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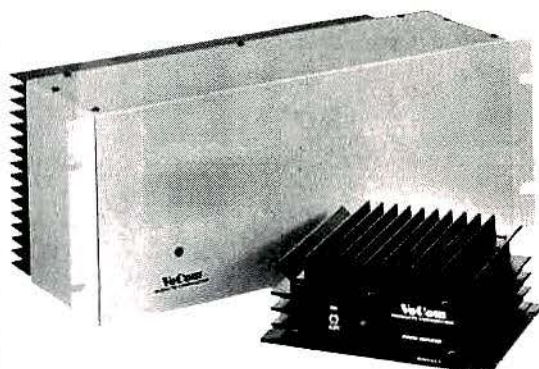
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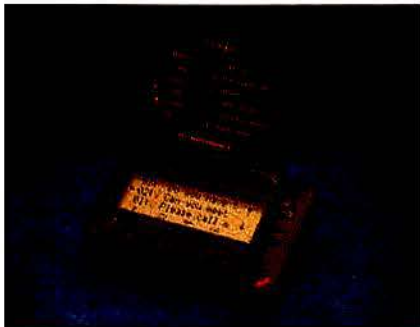
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FAX: 708-924-9078



Circle (40) on Fast Fact Card

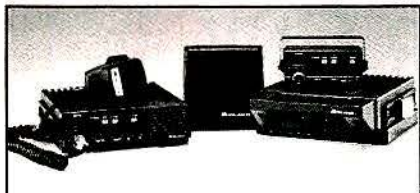
Alphanumeric pager features preprogrammed responses



Tango, from Motorola's Advanced Messaging Systems Division, is the first two-way alphanumeric pager to operate on the ReFlex system. Users can respond to messages directly from their pager by selecting one of many preprogrammed responses or from a list of multiple choice replies included in the originator's message. As many as 100,000 characters can be received and stored in memory. The pager can be connected to most computers via a serial interface for downloading long messages or for customizing acknowledgment responses. When the pager is connected to a PC through the data port, it acts as a wireless modem by transmitting computer-created messages back to the service provider where they are routed to other wireless or wireline destinations. Features include time and date stamp, alarm clock, backlit LCD and four user-selectable alert settings, including silent vibration.

Circle (403) on Fast Fact Card

Mobile offers programmable channel spacing options



The Syn-Tech XTR Multi-Mode FM two-way radio from Midland LMR features programmable channel spacing to meet the demand for narrowband capability. The frequency-synthesized mobile offers channel spacing of 12.5kHz and 25kHz in addition to 15kHz and 30kHz. The spacing of each channel can be programmed individually, as needed, to ensure complete compatibility.

Circle (404) on Fast Fact Card

Software designed for Depot Repair automation includes accounting

ServicePlus Series 3 software is a Windows-based version of ServiceWare's Series 2 Service Information System (SIS). The first version of Series 3 is an SIS product designed specifically for Depot Repair automation and includes the following modules: Logbook; logistics; order entry; SP manager; and interfaces for AccPac Plus, Great Plains

and SBT accounting systems. Features include resolution statistics, shipping and receiving, flat-rate billing, unlimited jobs per work order and work flow, a mechanism that allows customers to define ServicePlus behavior and accurately reflect their processes, business and service cycles.

Circle (405) on Fast Fact Card

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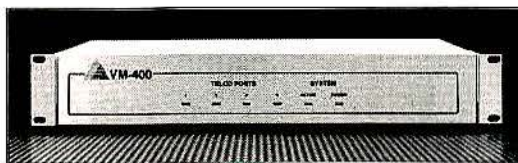
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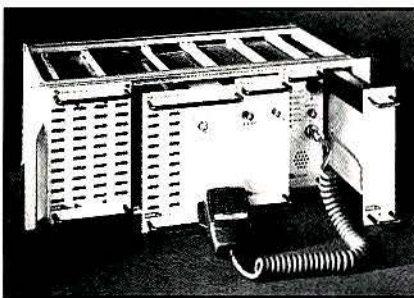
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Circle (48) on Fast Fact Card

New products

Data-capable modular VHF repeater includes self-diagnostics



The 30W KV-16RP VHF repeater sta-

tion from KAVIcomm is a 19" rackmount unit with 16 synthesized channels. Operating at frequencies of 66MHz-88MHz and 134MHz-174MHz, the unit offers 30kHz, 25kHz and 12.5kHz channel spacing. Features include modular construction and CTCSS decoding and regeneration. Self diagnostics are visible on the front panel. Designed to accommodate interfacing with SCADA systems, the repeater is data-capable and has isolated 600Ω audio inputs/outputs.

Circle (406) on Fast Fact Card

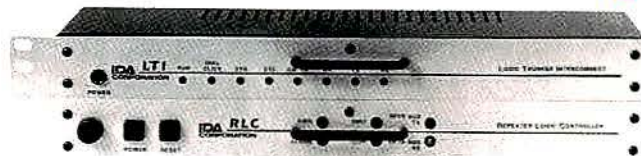
Battery monitor informs user of battery's condition

The BatteryLite informs any lead acid battery user of the battery's condition. The unit from Photron draws less than 0.005A but provides a battery state of charge (SOC) readout in percentage along with SOC trend and ten critically important battery alarm conditions. The palm-size unit requires 2-4 small-gauge wires for hookup and is available in surface-mount and flush-mount versions.

Circle (407) on Fast Fact Card



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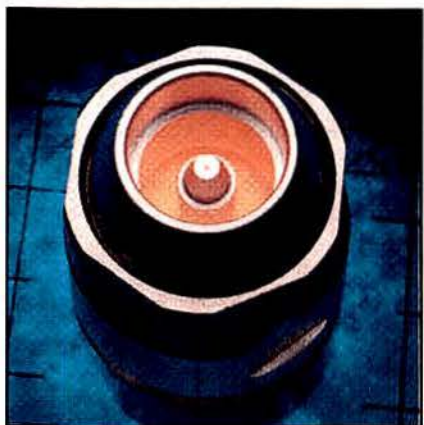
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Circle (49) on Fast Fact Card

Connector for 7/16 DIN applications includes O-ring sealing



The EZ-900-716C from Times Microwave is a 7/16 DIN plug connector for

LMR-900. The center conductor is captivated to assure proper pin depth, and the design includes integral O-ring weather sealing. All portions of the connector in the RF path are silver-plated, and the matching section of the connector provides better than 1.1:1 VSWR to 2GHz. Installation is simplified by using the ST-900/1200C stripping tool and by the center conductor design. The stripping tool strips the jacket off of the cable to the correct dimension, and the task of tapping the center pin of the connector into the center conductor of the cable is eliminated by the use of a push-in center contact. Reliable contact to the center conductor is made by silver-plated spring fingers.

Circle (408) on Fast Fact Card

Metallized materials provide architectural EMI/RFI protection

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Circle (409) on Fast Fact Card

UNCONDITIONAL REPEATER PERFORMANCE



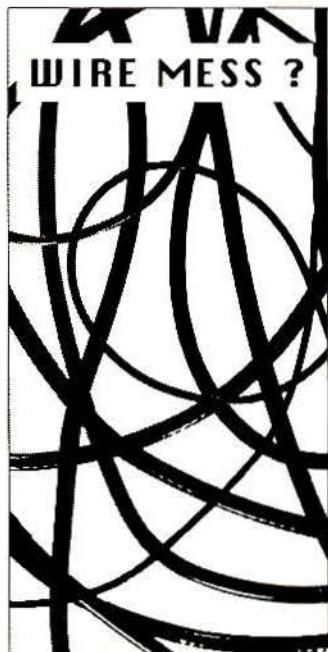
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Circle (52) on Fast Fact Card

P eople

Changes at Nextel Communications, Rutherford, NJ:

Wayland R. Hicks resigns as vice chairman and chief executive officer (CEO) to be replaced by **Dennis Weibling** as acting CEO. Weibling is president of Eagle River, **Craig O. McCaw's** private investment company. McCaw is chairman of Nextel's operations committee. **Brian McAuley**, one of Nextel's founders, vacates his position as president to become a vice chairman.

Justin Jaschke, the company's executive vice president for marketing, customer care and strategy, adds to his responsibilities as he becomes the chief operating officer. Jaschke had been president of OneComm, which merged with Nextel.

Paul D. Mueller, who previously was president of Transcript International, Lincoln, NE, becomes vice president of sales and marketing for Phoenix Wireless Group, Maitland, FL.

Jim Gilley, senior engineer for Transcript International, advances to chief scientist.

Changes at Hutton Communications, Dallas:

Jeff Curtis departs Photocomm, Scottsdale, AZ, as senior sales engineer to join Hutton as area sales manager for the Power Systems Group.

Richard Romero leaves The Brice Group, Carrollton, TX, as director of logistics to become vice president of operations for Hutton.

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2032

Circle (53) on Fast Fact Card

Changes at IFR, Wichita, KS:

Fred E. Arnold leaves Dorne and Margolin/CHU Technology, Bohemia, NY, as president to become chief operations officer for IFR.

Ronald J. Hollas leaves Harris, Melbourne, FL, as Asia Pacific sales director to join IFR as communications marketing manager.

Samual Kyeung Lee, electrical design engineer, advances to director of business development for the Pacific Rim.

Michael McClelland exits The Koch Crime Commission, Wichita, as communications specialist to become marketing communications administrator for IFR.

Anthony W. Sutton leaves Schlumberger Technologies, Billerica, MA, as a sales manager to join IFR as director of sales.

James D. DeBelina departs Motorola, Schaumburg, IL, as North American sales director for wireless network products to join Illinois Superconductor, Mt. Prospect, IL, as vice president sales and marketing.

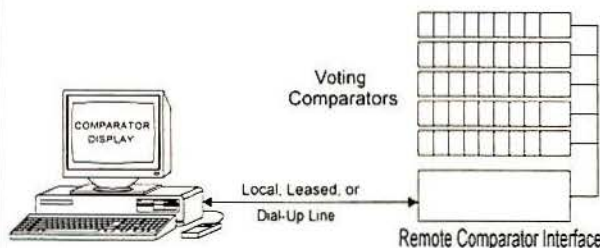
Changes at Allen Telecom Group (ATG), Cleveland:

Dale Bastian, vice president of North American sales, moves up to senior vice president for North American sales and marketing.

Martha LeVasseur leaves Ohio-based Alltel Publishing as vice president of marketing and business development to join ATG as marketing director.



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Circle (43) on Fast Fact Card

Spectrum guide gives engineers access to frequency allocations

The second edition of *Spectrum Guide: Radio Frequency Allocations in the United States, 30MHz-300GHz* by Bennett Z. Kobb is intended for readers in RF engineering, business and product development. The 311-page guide profiles major commercial, government and scientific uses of the U.S. spectrum in more than 300 bands from VHF through EHF. These in-

clude personal communications services (PCS), wireless data, cellular, video services and unlicensed RF devices. The book from **New Signals Press** and **Publication Services** includes official data from the U.S. Table of Frequency Allocations, as well as subject and band indexes.

Circle (301) on Fast Fact Card

Communications manual covers instrumentation, testing techniques

Standard Radio Communications Manual: With Instrumentation and Testing Techniques by **R. Harold Kinley** is available in a new format: 8½" × 11" looseleaf notebook. This book contains more than 400 pages of illustrations, charts, graphs and step-by-step test procedures to explain the instrumentation and procedures necessary for performance testing AM, FM and SSB equipment, as well as antennas, transmission lines and other related equipment. Quarterly supplements will be offered to be inserted in the notebook to keep the book up to date.

Circle (302) on Fast Fact Card

Buyers' guide focuses on site construction, maintenance products

The 1995-96 edition of Tescos's **Site Management Buyers' Guide** contains site construction and maintenance products for SMR through PCS frequencies. The 328-page guide consolidates the offerings of more than 95 manufacturers, with full side-by-side product descriptions. Three indexes help the user locate any item quickly.

Circle (303) on Fast Fact Card

Catalog outlines switch matrix technology

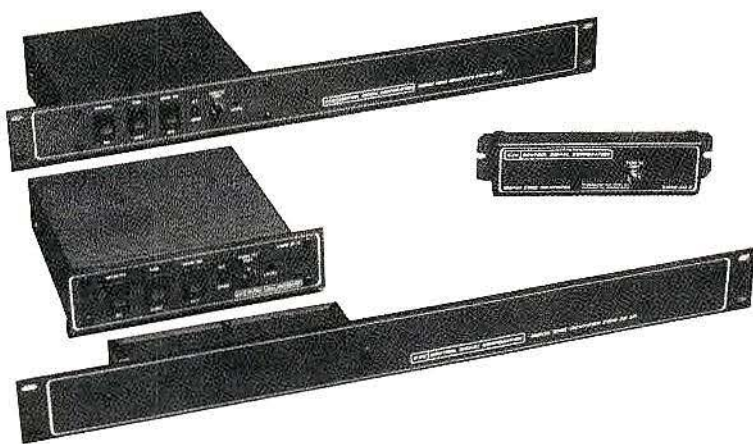
A 28-page color catalog from **ST Olektron Systems** outlines new switch matrix technology and other related components for switching RF, microwave and digital signals. Other products include specialized devices for SATCOM, FAA and automated component testing applications, as well as LAN interface modules, RF multicouplers and high intercept amplifiers. Data sheets outline complete information on frequency capabilities, input and output configurations, switching speeds and other important specifications.

Circle (304) on Fast Fact Card

Data sheet details features, specs of ANVIL monitor

A four-page data sheet from **Noise Com** details the applications, features and specifications of the ANVIL monitor, which determines antenna problems. Charts and diagrams aid in the descriptions of the monitor's features and functions. In addition, the data sheet provides ordering information and instructions for quick reference and easy purchasing.

Circle (305) on Fast Fact Card



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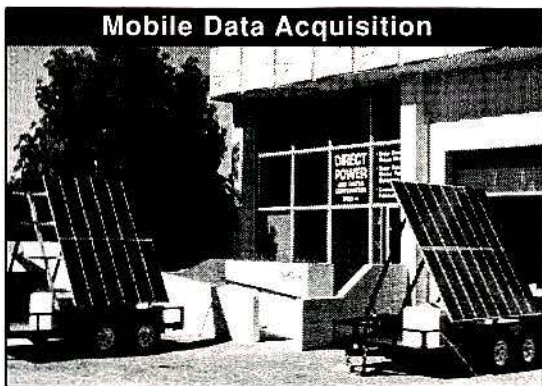
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Catalog describes attenuating headsets for two-way radios

A 12-page color catalog and supplement describe **David Clark's** line of noise attenuating headsets, radio adapters and accessories for two-way radios. The catalog provides information and specifications on the series 3000, 7000, 7100 and 7200 noise attenuating headsets and adapters for portable and mobile radios. The color supplement introduces the series 6000 noise attenuating headsets with noise canceling microphones and radio adapter cords.

Circle (306) on Fast Fact Card

Short-form catalog features rechargeable lithium batteries

Tadiran Electronic Industries has updated and expanded its lithium battery short-form catalog. New features include the In-Charge rechargeable lithium metal AA cylindrical. Categories of batteries are primary power cylindricals—high capacity; memory backup; high-temperature; high power; and automated utility meter—wafers; and assemblies for PC real-time clock and CMOS memory backup.

Circle (307) on Fast Fact Card

Catalog includes 2,700 new items

The 36th catalog from **MCM Electronics** contains more than 2,700 new items, including project accessories, semiconductors, connectors, test equipment and computer products. The catalog also introduces LAN cable test products, high-quality crimping tools and many other new items for the electronics service technician.

Circle (308) on Fast Fact Card

Catalog covers lowpass filters

A new catalog from **Microlab/FXR** describes high-power coaxial lowpass filters. The models featured are available for use in the 100MHz to 2,000MHz region and with average power levels of up to 750W.

Circle (309) on Fast Fact Card

Selection guide features antennas

Antenex's selection guide lists new products, including the Voyager omnidirectional base station antenna and true compact wideband mobile antennas. The guide includes color photos, graphs, charts, specs, plots and vertical field patterns to simplify the buying decision.

Circle (310) on Fast Fact Card



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Circle (46) on Fast Fact Card

Product/services showcase

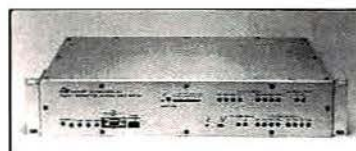
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Spread Spectrum Radio Modem

The GINA 64kbps spread spectrum radio modem from **GRE America** allows asynchronous and synchronous data transmission at speeds up to 64kbps throughput with RS-232, RS-449 and V.35 interfaces.

Circle (201) on Fast Fact Card



Transmitter Steering Controller

The TSAM-1 transmitter steering controller from **CTI Products** works with existing comparators and receiver voting electors to steer eight transmitters. It includes fully programmable control tone generation and CTI Products' exclusive Smart-Steer algorithm. It is expandable to 64 transmitters.

513-595-5900

Circle (202) on Fast Fact Card



Trunking Option for Test Set

Wavetek's 4015 Stabilock test set is designed for efficient servicing. A wide selection of testing possibilities for communications systems is provided, including a new EDACS trunking option. Integrated selfcheck and autocalibration are standard features.

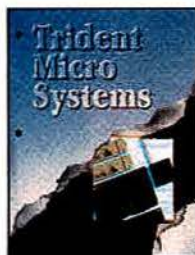
Circle (203) on Fast Fact Card



Coaxial Protector for GPS

PolyPhaser introduces a coaxial protector for GPS receivers with active antennas. The IS-MR50LNZ+6 protects in-line amplifiers and GPS receivers, providing optimal protection for dc and RF paths on coax. With positive and reverse voltage protection, it exhibits low loss and low VSWR over a large bandwidth.

Circle (204) on Fast Fact Card



Wireless System Components

Trident Micro Systems manufactures a variety of products for the wire-

less industry including trunking controllers, air time loggers and mobile data terminals with GPS. In addition to ESN modules with over-the-air programming, data modems and other components for 220MHz, 800MHz, 900MHz and conventional systems are available in the new catalog.

800-798-7881

Circle (205) on Fast Fact Card



High Q Bandpass Filters

A new series of high Q bandpass filters offers tunable quarterwave cavities in a variety of diameters for increased Q, selectivity and low loss while suppressing interference from 30MHz to 950MHz.

Available from **Microwave Filter**, these filters can be used as preselectors or to clean up spurious transmit signals. Five different sizes are available in single, double and triple cavities. The units have rotating loops and an adjustable resonator for field tuning.

Circle (206) on Fast Fact Card



Workstation Screens

Modular Communication Systems' consoles and stand-alone workstations for emergency communications feature MODUCOM's "Screenmaker" and "Customizer" software that allows user design of screens for specific operating requirements and applications.

Circle (207) on Fast Fact Card



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Circle (208) on Fast Fact Card



Trunking Repeater Manager

The LT-4200 LTR trunking repeater manager from **Connect Systems** is designed to be compatible with the repeater bus used by all major brands. This control panel includes a front panel LCD that displays current user ID, repeater status, HELP data and programming details. Front- and rear-panel RS-232 ports allow use of a modem, PC or laptop to perform local or remote programming in addition to downloading programming data and user time accumulations.

Circle (209) on Fast Fact Card

Scrambling for MicroTAC

Portable telephone security, invisibly embedded into Motorola MicroTACs, is activated with a simple keypad combination. Proven Crypto Voice Plus technology from **Transcrypt International** is compatible with its other scramblers for complete cellular and office security. Call 800-228-0226.



Circle (210) on Fast Fact Card

Air-dielectric Radiating Cables



Trilogy Communications introduces RMC² radiating cables for RF-restricted areas (buildings, subways, tunnels, etc.). Product features include: the only hermetically sealed low-loss air-dielectric cables available and they require no pressurization. No soldering for connectorization, and RMC² costs far less than corrugated copper cables. Available in 50Ω and 75Ω.

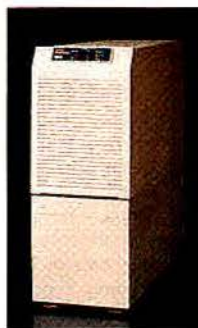
Circle (211) on Fast Fact Card



Full-scan Analyzer

The 486-based COM-120B from **IFR Systems** provides near real-time spectrum analyzer and scope displays with virtually no keyboard buffering. It includes a crossband duplex system, a digitized full-scan spectrum analyzer with optional tracking generator and a PCMCIA memory card. Options include POCSAG, Clearchannel LTR, EDACS and AMPS test capability.

Circle (212) on Fast Fact Card



UPS Systems

SMART DataCenter UPS systems from **Tripp Lite** are available in 3KVA and 5KVA sizes. They feature 14 ac outlets (120Vac and 208Vac) with expandable battery capacity.

Circle (213) on Fast Fact Card



Integrated mobile antenna

Cushcraft has developed a new line of mobiles that incorporate an integrated, one-piece base design. A flexible enclosure skin resists structural blow, contaminants, sun, moisture and broad swings in temperature. The one-piece design eliminates the opportunity for rain to leak into the antenna. Available from 800MHz to 900MHz.

Circle (214) on Fast Fact Card



Multi-function DTMF Encoder/Decoder

The NC4000 controls multiple remote operations with status verification reporting of both input and output active functions. It decodes all 16 standard DTMF characters, has an address length of one to eight digits and includes EPROM memory for non-volatile storage.

Norcomm

12438 Loma Rica #1
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916-477-8400

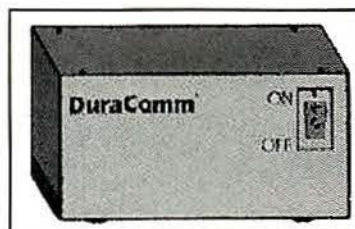
Circle (215) on Fast Fact Card



UHF Four-cavity Duplexer

TX RX Systems' model 28-70-02A pseudo-bandpass duplexer uses the patented Vari-Notch circuit to provide maximum isolation for the lowest insertion loss possible. Fully temperature-compensated and manufactured to the highest standards, this duplexer will provide years of unequalled and trouble-free performance.

Circle (216) on Fast Fact Card



Desktop Power Supply

The super-quiet 22A desktop power supply from **DuraComm** features auto reset and is switchable, 110V/220V. Weighing less than 3 pounds, the unit provides ac/dc line filtering, MOV line input protection and overvoltage/current protection. Supplies for 7A, 11A, and 15A are also available.

Circle (217) on Fast Fact Card

Product/services showcase



Medium-wave Isolators

Eagle's new medium-wave isolators allow use of existing AM band towers for VHF, UHF or cellular antennas. The isolators can handle 25,000W of medium-wave power, as well as 1,000W of through power. Price: under \$200.

Eagle
P.O. Box 4010
Sedona, AZ 86340
520-204-2597

Circle (218) on Fast Fact Card

Replacement Antenna

Centurion International's fixed replacement antenna for the Motorola MicroTAC phone eliminates the hassle of pulling up a retractable antenna. The quarterwave, fully molded, stubby design retains the flip phone's compact profile. The CXS-MFP is easy to install—just pull out the retractable antenna and snap on the Centurion replacement.



Circle (219) on Fast Fact Card



Small Console

DSPatch32 is a small console with big system features, configurable to support 32 lines or operator workstations with touch or mouse operation. External lines may be for radio, telephone circuits, intercom or other use.

Avtec
803-892-2181; fax 803-892-3715
Circle (220) on Fast Fact Card



Lease-line Replacement

The **4WFD-FIP** from **DataCom** replaces the wired connection between data centers and/or other leased line sites. Standard features include: full-duplex operation; 100% duty cycle; order wire; and integral six-bay cavity duplexer. The 4WFD-FIP supports as much as V.34 modulation to achieve asynchronous non-compressed data rates as high as 28.8kbs.

Circle (221) on Fast Fact Card



Signaling Products

The 1996 signaling products catalog and updated price list is available from **Vega**. The products described in the catalog are

designed to meet signaling requirements—whether for tone-remote or dc remote-control consoles, remote station adapters, tone encoders and decoders or any of a wide variety of system modules (line termination cards, summing amplifiers, line drivers, single-tone encoders and decoders, notch filters and relay cards.)

Circle (222) on Fast Fact Card



Battery Analyzer

Cadex's C7000 programmable battery analyzer simultaneously services NiCd, NiMH and SLA batteries. More than 800 configured adapters are available for batteries for portable radios, cellular phones, laptops and camcorders.

Circle (223) on Fast Fact Card



TDMA Test System

The new **Motorola TDMA TruTest** system is a convenient, accurate way to test TDMA cellular phones. The system includes three components: TDMA-1000, a portable EAMPS and TDMA dual-mode cellular test unit; Micro RF Isolator, which provides isolation from external RF interference; and a cellular test kit. Call 800-505-TEST.

Circle (224) on Fast Fact Card



Trunking Systems Link

Net-Link is a software and hardware package providing multi-user and multi-site linking among LTR trunking systems. Developed by Rayfield Communications and sold exclusively by **IDA**, the Wordsaver technology makes the Net-Link transparent to the end user. Call 800-627-4432.

Circle (225) on Fast Fact Card



Multi-channel Remotes for Midland Radios

The new **MCR310** and **MCR320** remotes from **CPI** give full control of Midland's Syn-Tech XTR radios, for as many as 99 channels. The remotes provide controls for channel up/down, P-scan, N-scan, add/delete, monitor, PTT, intercom and volume. Other features include 2W of speaker audio, LED channel readout and LED indicators for PTT, scan, monitor and A/D.

Circle (226) on Fast Fact Card



Band-reject Duplexers

With 5MHz separation in VHF (4MHz UHF), this duplexer from **EPCOM** features low insertion loss and high TX/RX isolation.

El Paso Communication Systems
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915-533-5119; fax 915-542-4701

Circle (227) on Fast Fact Card



Buyers' Guide

TESCO's 1995-96 Buyers' Guide features six tabbed sections covering infrastructure products, mobile and portable accessories, antennas, bench equipment and test and maintenance gear, with complete product specifications. 800-472-7373; fax 410-472-7575; web site <http://www.tesco.com>.



Replacement batteries

W&W Associates is a U.S. manufacturer of replacement batteries and chargers for two-way radios. The company's MasterCharger series is available in single, double and six-station units with interchangeable cups for a wide selection of manufacturers. Call 800-221-0732.

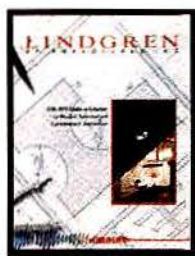
Circle (228) on Fast Fact Card



Cable, Antenna Analyzer

Site Master is a precision analysis tool that measures SWR, return loss and distance-to-fault on both analog and digital RF transmission lines. The unit from **Anritsu Wiltron** has a frequency range of 25MHz to 3,300MHz and rejects external RF interference.

Circle (229) on Fast Fact Card



Shielding Systems

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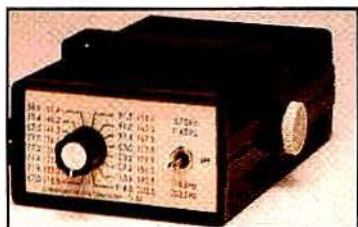
Circle (230) on Fast Fact Card



Cable Packaging System

The Reel Pax packaging system from **Andrew** makes handling, dispensing and cutting both superflexible cable and braided coaxial cable easier. Each Reel Pax is a compact, durable carton that holds one 500-foot reel of 1/4" or 3/8" superflex or braided cable. The 1/2" superflex comes in 250-foot reels. Call 800-255-1479, ext. 126.

Circle (231) on Fast Fact Card



Tone Encoder

The TE-32 tone encoder from **Communications Specialists** gives direct access from a front-dial rotary switch to all EIA CTCSS tones from 67.0MHz to 203.5MHz. It is housed in a high-impact plastic case and is supplied with a mounting bracket, hardware and a three-foot shielded cable.

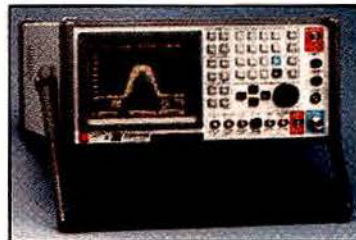
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SCADA and Telemetry Systems

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Circle (233) on Fast Fact Card



Wireless Communications Service Monitor

Hutton Communications is now an authorized stocking distributor for IFR. The COM 120B is an advanced wireless communications service monitor providing lightning-fast operation. 800-442-3811; fax 214-239-5264

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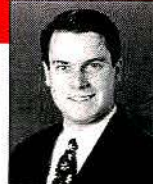
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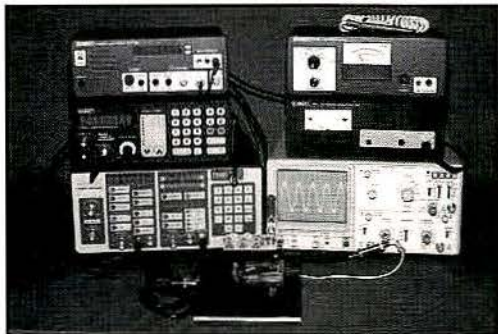
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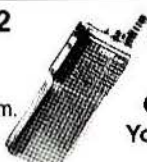
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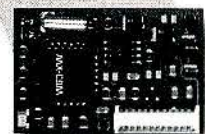
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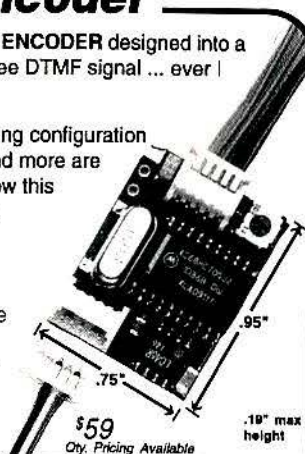
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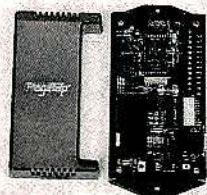


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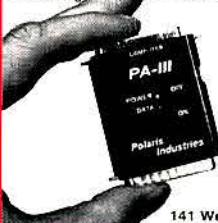


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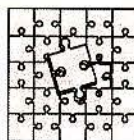
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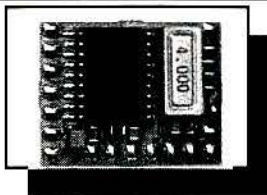
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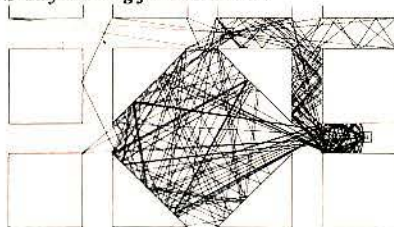
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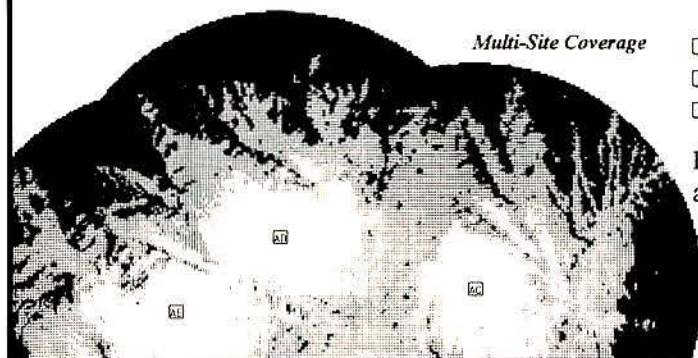
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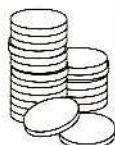
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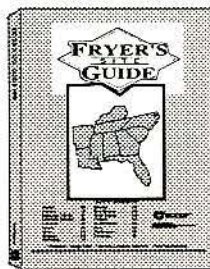
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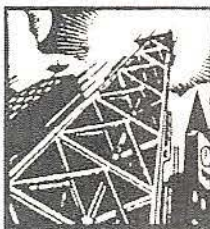
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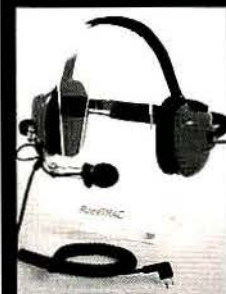
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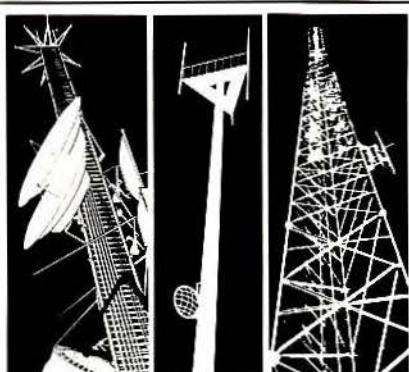


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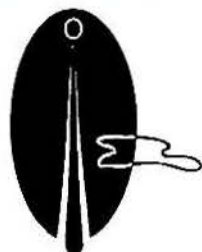


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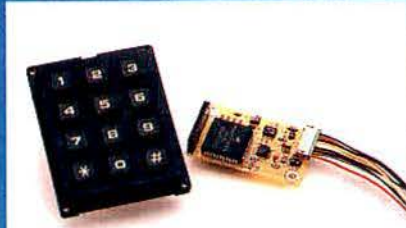
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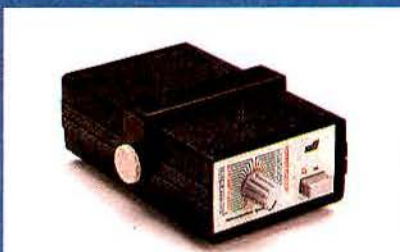
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